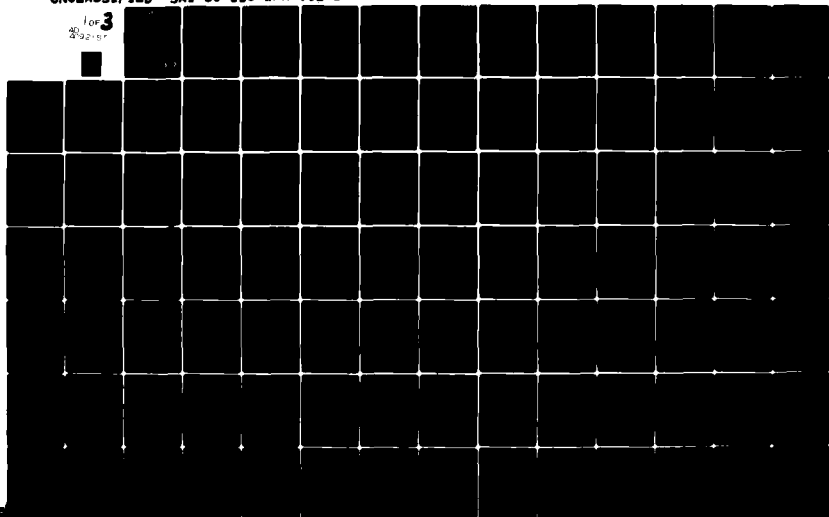


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AN ASSESSMENT OF THE HYPOTHETICAL IMPACT
OF DRUG ABUSE ON COMBAT CAPABILITY

VOLUME II - FINAL REPORT

B. Tullington
H. Strickland
D. Gaebel

April 1980

Supported by:

U.S. Army Medical Research and Development Command
Fort Detrick, Frederick, Maryland 21701

Contract No. DAMD 17-79-C-9107

Science Applications, Incorporated
1710 Goodridge Drive
McLean, Virginia 22102

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DEPARTMENT OF THE ARMY
WALTER REED ARMY INSTITUTE OF RESEARCH
WALTER REED ARMY MEDICAL CENTER
WASHINGTON, D.C. 20012

REPLY TO
ATTENTION OF: SGRD-UWI

16 July 1980

To the Reader:

Recently, the US Army Medical Research and Development Command was tasked to characterize the impact of individual performance degradation on unit combat readiness. This report is the product of a research effort directed at satisfying this research requirement.

Drug use by our service members is a complex multi-dimensional phenomenon. It is common to hear of, and read about, the drug problem in the military. Unfortunately, seldom is there agreement as to the nature of this problem. This lack of consensus stems from the fact that drug use and abuse pose multiple problems for our armed forces. Depending on one's perspective and responsibilities, the drug problem may be one related to health, performance, control, prevention, morality, discipline, or a number of other vital issues. The current tasking focused attention on still another dimension of the problem. Namely, how well combat units could perform their essential missions if the performance of individual unit members had been degraded in some way by the use of drugs?

The tasking presented an extraordinary challenge. Drug use by our service members is almost always intermittent. Different drugs are used at different times, in varying combinations with one another and in varying doses. The effects of drugs on performance vary with time since administration. Performance demands themselves vary from military job to military job, from unit to unit and across operational settings. In combat the effective military unit makes demands on all human physical and mental faculties as well as the full range of sensory and motor skills. The task of arraying individually abused drugs and combinations of abused drugs, in varying amounts and at different times since administration, against all of the performances and skills required for effective unit performance is beyond the scope of any scientific undertaking. Even if it were possible to complete such a matrix, the essential question of whether a given military unit could perform its essential functions would remain unanswered for options exist for commanders to substitute personnel and augment essential teams as circumstances warrant.

16 July 1980

For the reasons stated above, an alternative strategy was selected. Science Applications Incorporated, (SAI) was asked to utilize its AMORE methodology to examine how the loss of certain skills and performances would limit the capacity of different types of military units to perform their essential missions. Because both civilian and military scientists have demonstrated that the population at risk, or most likely to be involved in drug use, is under age 25, SAI was asked to determine which jobs in a number of military units are likely to be occupied by soldiers under age 25. These jobs represented the pool of skills and performances available to the unit from its under 25 population. Because drug use tends to be limited to this age group, this pool of skills and performances is also that most likely to suffer degradation from drug use.

Because it is impossible to specify how much degradation would occur in any individual, SAI was told to assume that drug use reduced an individual's utility to zero. That is, that the individual could contribute none of the performances and skills associated with his military job. It was recognized from the outset that this represented an extreme case, but it was nonetheless one way of characterizing the resiliency of our current tables of organization and equipment (TOE's) in the face of the loss of certain skills and performances. For successive computer runs SAI was directed to eliminate from availability, first ten, then twenty, thirty and forty percent of the military jobs occupied by soldiers under age 25, and then to determine the capacity of the unit to carry out its essential functions. SAI was instructed to then inflict further damage of the kind to be anticipated in combat to both the unit's personnel and equipment and again to determine the impact on the unit's capacity to perform its essential missions.

This report arrays the results of the research effort described above. It describes how losses of skills and performances of individuals most likely to be involved with drugs would reduce the capacity of units to perform their essential functions. Furthermore, it indicates rather clearly that TOEs differ in the degree to which drug use might limit their combat capability. The threat of functional failure due to drug use appears greatest in those units where younger soldiers perform critical functions and commanders have few options with respect to substitutability of personnel.

The AMORE methodology assesses the capacity of units to perform critical functions by attempting to rebuild mission essential teams out of the skills and performances available to the commander following personnel losses. When a team cannot be

SGRD-UWI

16 July 1980

built, the AMORE system identifies the reason, typically the lack of a suitably trained individual that can substitute for a specific personnel loss. For this reason, the report also contains listings by MOS of critical personnel whose loss, whether due to drug abuse or combat damage, deprives the commander of the resources to reconstitute essential teams. The commander concerned with possible shortfalls in performance by identified individuals afflicted with serious drug or alcohol problems can view these critical skill lists as a basis for assessing the impact functional failure of these individuals might have on unit capability and can make judgements as to the merits of cross-training other personnel to minimize my potential adverse impact.



FRANK J. SODETZ

LTC, MSC

Contracting Officers Technical
Representative

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER SAI-80-113-WA-VOL-2	2. GOVT ACCESSION NO. AD-AC92155	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AN ASSESSMENT OF THE HYPOTHETICAL IMPACT OF DRUG ABUSE ON COMBAT CAPABILITY. VOLUME II.		5. TYPE OF REPORT & PERIOD COVERED FINAL REPORT FOR PERIOD December 1979-March 1980
7. AUTHOR(s) B. Tullington H. Strickland D. Gaebel		6. PERFORMING ORG. REPORT NUMBER SAI-80-113-WA
9. PERFORMING ORGANIZATION NAME AND ADDRESS SCIENCE APPLICATIONS, INC. 1710 Goodridge Drive McLean, Virginia 22102		8. CONTRACT OR GRANT NUMBER(s) DAMD17-79-C-9107
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND Ft. Detrick, Fredrick, MD 21701		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62771A 3E162771A804/00.009
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Division of Neuropsychiatry Walter Reed Army Institute of Research Washington, D.C. 20012		12. REPORT DATE Apr 1980
		13. NUMBER OF PAGES 141
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Combat Readiness Job Analysis Drug Abuse Operations Research		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Forward Support Company, Combat Engineer Company, Supply and Service Company and Forward Communication Company organizations are analyzed to examine potential unit effectiveness before and after combat damage assuming personnel incapacitation from hypothetical drug abuse distributions of 10%, 20%, 30%, and 40% among those personnel less than 25 years of age. The relative risk to loss of unit effectiveness from drug abuse is quantified, and personnel functions key to unit mission accomplishment are identified (by MOS) before and after combat damage. Additionally, equipment critical to unit effectiveness is identified and its impact on unit capability discussed. The		

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20. impact of expanding the age threshold from 25 to 28 is examined and found to be significant for HHC, Mechanized infantry Battalions.

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PREFACE

This analysis of the impact of hypothetical drug-abuse distribution on the combat effectiveness of select support and service organizations was requested by the Department of Neuropsychiatry, Walter Reed Army Institute of Research. Specifically, this work, when added to the previously published basic report, provides an analysis of a wide spectrum of divisional-type company-size units found in the Army in Europe. The basic document reports on the combat units. This addendum adds a Forward Support Company, Combat Engineer Company, Supply and Service Company and a Forward Communications Company. Neither document considers the impact of actual drug abuse nor the effects of specific drugs. Units are examined by a computer-assisted methodology, assuming various levels of drug abuse among those susceptible to drug abuse, to determine what the impact on unit combat effectiveness would be if the drug abuser could not perform his/her assigned function.

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CHAPTER 1 SUMMARY

SECTION I INTRODUCTION

1. PURPOSE

The purpose of this research is to assist the U.S. Army in defining the potential functional impact of hypothetical distributions of drug abuse on combat capability. The basic effort examined the organization of the company-size units in armor, artillery, and infantry battalions. This study expands that analysis to select combat support and combat service units to provide a more meaningful and complete evaluation of the relative risk of functional failure from drug abuse faced by U.S. Army divisional units in Europe. Units examined are the forward support company, combat engineer company, supply and service company, and a forward communications company. The headquarters company, infantry battalion is reexamined assuming drug-abuse susceptibility is expanded to include those personnel less than 28 years of age. These results are compared with the previous analysis, which considered drug-abuse susceptibility limited to personnel less than twenty-five years of age.

2. BACKGROUND

The basic report contains detailed descriptions of the technical approach and methodology which also apply to this study. This report assumes the reader is familiar with that technical approach, and, to avoid repetition of explanations common to all units, only that detail considered necessary for continuity and clarification will be included in this addendum. A review of the technical approach, discussed briefly in Chapter 1, Section I of the basic report, may facilitate understanding of the findings and observations of this addendum.

This study examines the potential impact on unit effectiveness from a worst-case point of view, using hypothetical drug-abuse data. No degradation of performance due to actual abuse of a particular drug or drugs is specified or examined. Because the greatest potential impact (risk) on unit effectiveness can be expected when drug abuse results in total functional incapacitation, the unit

organizations are analyzed from that perspective. Quantification of the unit effectiveness following losses from drug abuse provides a means of comparing unit risk to potential critical functional failure from drug abuse.

3. THE APPROACH

The approach used in examining the support and service units is essentially the same as that used for the combat units, the major difference being the assumed mission for analysis. The measure of effectiveness used to quantify combat-unit capability is the ability to reconstitute teams to perform basic combat functions. Support and service units are evaluated by considering how well they can form essential teams to perform those basic support and service functions required by the combat units of the division. For example, the forward support company effectiveness is measured by how well it can support the combat unit of a type brigade engaged in intensive combat.

SECTION II SUMMARY OF FINDINGS

The results of this study are presented in summary form to facilitate review of the major findings. Results and observations are discussed in Chapter 3 (Forward Support Company), Chapter 4 (The Combat Engineer Company), Chapter 5 (The Supply and Service Company), Chapter 6 (The Forward Communications Company), and Chapter 7 (Headquarters Company Mechanized Infantry Battalion, Special Case).

1. RISK TO LOSS OF UNIT COMBAT EFFECTIVENESS

Each unit is examined to determine its capability to perform a specific mission following losses from several assumed combinations of combat damage and drug abuse. The percentage of mission-essential teams that could be formed following these losses is the measure of effectiveness for this study. The differences in degraded effectiveness are indications of the relative risk each unit faces of functional failure due to drug abuse.

As was the case with the combat units, there is a significant difference in effectiveness among units, following assumed losses from drug abuse. The percent of effectiveness for these units is shown in Figure 1-1 as a function of drug-abuse level for several combat-damage situations. Damage Case 0 assumes no personnel losses or equipment damage from combat, and reflects the impact of drug abuse alone on units at full TOE authorization. Damage Cases 1, 2 and 3 show how the same units are affected by adding combat losses (10%, 20% and 30%, respectively) to the different levels of drug abuse. Percent drug abuse (10%, 20%, 30%, and 40%) is the percentage of those personnel in each of the units that are susceptible to drug abuse, not the percentage of the entire unit population. Of the four units in Figure 1-1, Damage Case 0, the combat engineer company (ENG) is the least affected by drug abuse. Its capability is only slightly affected until the level of drug abuse reaches forty percent, when effectiveness falls to eighty percent. The forward support company (FSC) follows a similar pattern at slightly greater risk. The forward communications company (COMM) and supply & service company (S&S) has a much greater potential loss in effectiveness. Both units fall below sixty-five percent effectiveness at the forty percent drug-abuse level. As combat damage is added to the losses from drug abuse, the relative loss in effectiveness remains approximately the same except when combat losses reach thirty percent across the entire unit (Damage

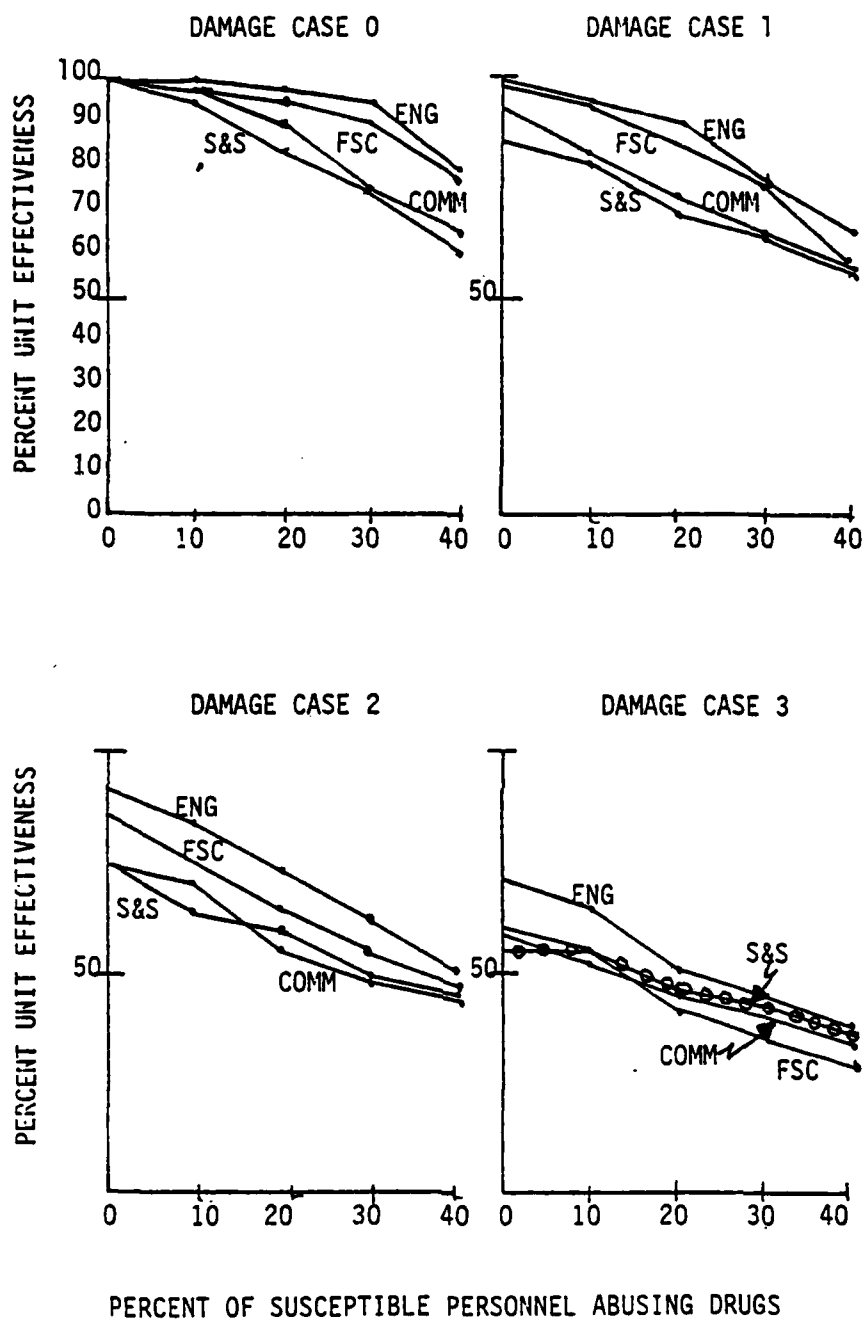


FIGURE 1-1. SUMMARY OF UNIT EFFECTIVENESS AT VARIOUS DRUG-ABUSE LEVELS AND DAMAGE CASES.

TABLE 1-1. SUMMARY OF UNIT TOLERANCE RATIOS.

THE RATIO OF THE PERCENT EFFECTIVENESS LOST
TO PERCENT INCREASE IN DRUG ABUSE FOR EACH
COMBAT DAMAGE CASE.

Tolerance Ratios

UNITS	Effect of Drug Abuse At			
	Damage Case 0	Damage Case 1	Damage Case 2	Damage Case 3
Armor Bn				
HHC	.00	.02	.02	.40
C/S Co	(.56)	(.76)	(.64)	(.64)
Tank Co	.06	.29	.55	.53
F.A. Bn				
HHB	(1.30)	.59	.42	.38
Svc Btry	.52	.63	(.70)	(.66)
FA Btry	.68	(.71)	.64	.51
Inf. Bn				
HHC	.06	(.35)	.46	(.48)
C/A Co	(.63)	.36	(.48)	.35
Rifle Co.	.49	(.49)	.40	.44

Combat Units

Fwd Spt Co.	.83	(.99)	.97	.82
Cmbt. Eng. Co.	.46	.85	(1.02)	.79
Sup & Svc Co.	(.94)	.88	.87	.62
Fwd Com Co.	(.99)	.81	.74	.47

Support and Service Units

Case 3). Then FSC has the highest risk to drug abuse, followed by COMM and S&S. The ENG company is least affected by drug abuse, due to a high degree of substitutability among key personnel.

From the data in Figure 1-1, a least squares, best fit, straight line was determined for each unit, the slope of which was defined as the organization's ability to sustain effectiveness in a drug environment. The slope is equal to the negative ratio of percent effectiveness lost to percent of drug-abuse increase. This ratio may be thought of as a measure of the unit's ability to function under increased levels of drug abuse and is called the tolerance ratio. A high number indicates a greater amount of effectiveness lost for each increment of increase in drug abuse. A ratio of one (1) indicates the percent effectiveness lost equals the percent increase in drug abuse. Table 1-1 lists the tolerance ratios for each of the units at each combat damage situation. The tolerance ratios of combat units determined during the basic analysis are also shown for comparative purposes. Examination of Table 1-1 shows the support and service units are generally less tolerant (higher ratio) to drug abuse than the combat units, both before and after combat damage. The circled entries indicate the highest ratios (poorest tolerances) within each battalion or support/service unit for the four combat damage cases.

Under combat conditions portrayed by Damage Cases 1, 2, and 3, collateral damage to equipment associated with these levels of personnel casualties also impacted on unit effectiveness. In some cases, damage to materiel limited the unit's ability to form teams to a greater degree than personnel losses. The limiting factors are shown in Table 1-2 with a letter to indicate the most limiting factor for each combination of combat damage and drug-abuse level. A "P" indicates the unit was limited in effectiveness as a result of personnel shortages for that particular combination of combat damage and drug abuse. An "M" indicates the unit had sufficient personnel to increase its effectiveness, but lacked the necessary materiel.

TABLE 1-2. SUMMARY OF LIMITING FACTORS

Damage Case	1					2					3				
	0	.1	.2	.3	.4	0	.1	.2	.3	.4	0	.1	.2	.3	.4
Fwd Spt Co.	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Cmt Eng Co.	M	M	M	P	P	M	M	M	P	P	M	M	P	P	P
Sup & Svc Co.	M	M	M	P	P	M	P	P	P	P	P	P	P	P	P
Fwd Comm Co.	M	M	M	M	P	M	M	M	P	P	M	M	P	P	P

The forward support company is personnel-limited in every case. The other units are generally materiel-limited at low damage/drug levels, but become personnel-limited as the drug-abuse levels reach .3 or .4. For example, in the forward communications company, unit effectiveness depends on materiel (except at high drug-abuse levels) even though the unit is also highly susceptible to lost effectiveness from drug abuse, as shown in Figure 1-1 and Table 1-1.

2. IDENTIFICATION OF PERSONNEL KEY TO UNIT EFFECTIVENESS

Personnel functions required for mission accomplishment were identified as essential and are listed for each of the company-size units in Chapters 3, 4, 5 and 6, respectively. By sampling the unit's ability to rebuild their essential teams following combat losses, those essential functions critical to reconstitution were identified. These personnel functions, ranked by criticality are listed in Table 1-3 (forward support company), Table 1-4, (combat engineer company), Table 1-5, (supply and service company) and Table 1-6, (forward communications company). Ordering by criticality was accomplished by determining how frequently shortages of a particular function could not be filled through substitution and in which teams the function was required. The more critical functions are those not easily filled when vacancies occur and those frequently required in essential teams. Note that those functions listed in the top part of each table are critical to the unit, considering only losses from combat uniformly applied to all personnel in the unit.

The increase in losses generated by introducing assumed incapacitating drug-abuse levels identified other critical functions. These additional critical functions resulting from losses from both combat and drug abuse are listed in the lower part of Tables 1-3 through 1-6. It is of interest to note that some of these added personnel become critical as an indirect result of drug abuse. The supply supervisor in the supply and service company (Figure 1-5, b), for example, has a probability of zero of being under twenty-five years of age. He has become critical due to the absence of a qualified substitute.

3. UNIT SENSITIVITY TO AGE DISTRIBUTIONS

The hypothetical impact of drug abuse on a headquarters and headquarters company (HHC) mechanized infantry battalion was examined with other combat units, assuming susceptibility to drug abuse was

TABLE 1-3. CRITICAL PERSONNEL FROM COMBAT DAMAGE
AND DRUG ABUSE, FORWARD SUPPORT COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
ARM MAT WO	42A1	0
MAT SUP SGT	76D3	.02
ARM MNT INSP	45K3	.07
SP ELEC DEV 5	35E2	.33
TANK TUR RP 1	45K1	.86
TANK TUR NCO	45K2	.30
FIRE CON IN 5	41C2	.31
D/M CEN OFC	36H2	.39
ARTILL REP 3	45L1	.78
ARTILL REP 5	45L2	.23
PWR GEN REP 4	52D1	.76
SPT SUPPLY WO	76A2	0
AUTO REP NCO	63H2	.32
SP ELEC DEV 4	35E1	.72
FLD RAD REP 5	31E3	.03
REC VEH OP	63F2	.44
FIRE CON IN 4	41C1	.78
FLD RAD REP 5	31E2	.48
FUEL/ELEC REP	63G1	.87
CONST EQ REP 5	62B2	.44
EQ CLK/MAT SP	76D1	.79
AUTO REP WO	63A0	.32
AUTO REP 4	63H1	.87

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
COMMANDER	77A0	0
PWR GEN REP-6	52D3	.04
SEC CH/MET	44B3	.06
FUEL/ELEC NCO	63G2	.31
SMALL ARM REP	45B1	.84
MATRL SUP SP	76D2	.26
REC VEH OPR	63F1	.90

TABLE 1-4. CRITICAL PERSONNEL FROM COMBAT DAMAGE
AND DRUG ABUSE, COMBAT ENGINEER COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
CONST EQ OP-5	62E2	.59
CEV COMMANDER	19E3	.04
CONST SPEC-4	12B1	.90
5 TON DRIVER	12B1	.90
CONST EQ OP-3	62E1	.88
CEV GUNNER	19E2	.12
PERS CARR DVR	12B1	.90
SQUAD LEADER	12B3	.06

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
CO COMMANDER	21A0	0
CEV DRIVER	19E1	.03
PLATOON LDR	21A0	.44
VEH DRIVER-4	12B1	.90
DEMO SPEC	12B2	.50
DEMO ASST	12B1	.90
CONST EQ OP-4	62E1	.88
CONST SPEC-4	12B1	.90
COMBAT CONST	12B1	.90

TABLE 1-5. CRITICAL PERSONNEL FROM COMBAT DAMAGE
AND DRUG ABUSE, SUPPLY AND SERVICE COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
POL SPEC	76W1	.86
SUB SPEC	76Y1	.78
PGEN & WVM	63B1	.87
ST SPEC	76V1	.73
SFC SGT	76D3	.02
MAT SPV	76D3	.02
WHSE OP	76V1	.73
SUP SPEC	76D1	.79
POL SPL	76W1	.86
MTL SUP	76D2	.26
CO CDR	92A0	0
SCT, SGT	76W4	0
SUB/SUP	76X1	.18
ST CLK	76D2	.26
QUAL SP	92C1	.76
PLL/SUP/SP	76D1	.79
SUP SG PH	76D4	.01
SUP SG/CIF	76Y3	.05

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
SUP SUPV	76X4	0
LOD OPR	62F1	.86
SUP TCH	76A1	0
ARMORER	76Y1	.76
PGEN MECH-5	63B2	.35

TABLE 1-6. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE, FORWARD COMMUNICATIONS COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
CO CDR.	25A0	0
WSYS TM CHIEF	36C2	.34
PGEN & WVM-4	63B1	.87
WSYS IN/OP	31N3	.08
PGEN & WVM-5	63B2	.35
TAC CKT CTL-4	31N2	.47
PGEN & WVM-4	63B1	.87
TEAM CHIEF	72E2	.36
PGEN & WVM-5	63B2	.35
CIR CTL SGT	31N3	.08
PLL CLERK	76D1	.79
MESSENGER	72F1	.87
TAC CKT CT 3-5	31N2	.47
PLT LDR	25A0	.43

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
RATT OP CHANN	05C2	.43
VEH DVR	72E1	.87
RAD OP RWI	05B1	.87
PLT SGT	31Z4	0
TAC CLT CTL-5	36C2	.34
TEL CT SP	72E1	.87

limited to those personnel less than twenty-five years of age. The results of this analysis are reported in Chapter V of the basic report. To test the leverage on effectiveness of age twenty-five as a limiting assumption, the probabilities of drug-abuse susceptibility were recomputed, expanding the age assumption to include those less than twenty-eight years of age. This resulted in seventy percent of the population being susceptible to drug abuse, as compared to 68.4% under the twenty-five year old assumption. The impact of this additional 1.6% (2.77 people) of the population on unit effectiveness is shown in Figure 1-2. The percent of unit effectiveness is shown as a function of the percent of susceptible personnel abusing drugs, both before combat (Damage Case 0) and after combat (Damage Cases 1, 2 and 3).

At Damage Case 0, there is no difference in effectiveness until the level of drug abuse reaches thirty percent and forty percent where there is a loss of eight percent in unit effectiveness for age twenty-eight threshold. With additional casualties from combat, the difference in effectiveness remains approximately eight percent at the higher drug-abuse levels (twenty percent to forty percent). There is no significant difference in effectiveness for drug-abuse levels of ten percent or less. A loss of eight percent in effectiveness is significant considering the small (1.6%) increase in population vulnerability.

It is also of interest to note that with the increased age threshold only two additional personnel functions were identified as critical to unit reconstitution; the Headquarters Commandant ($P < 28 = .532$) and the Senior Analyst ($P < 28 = .342$).

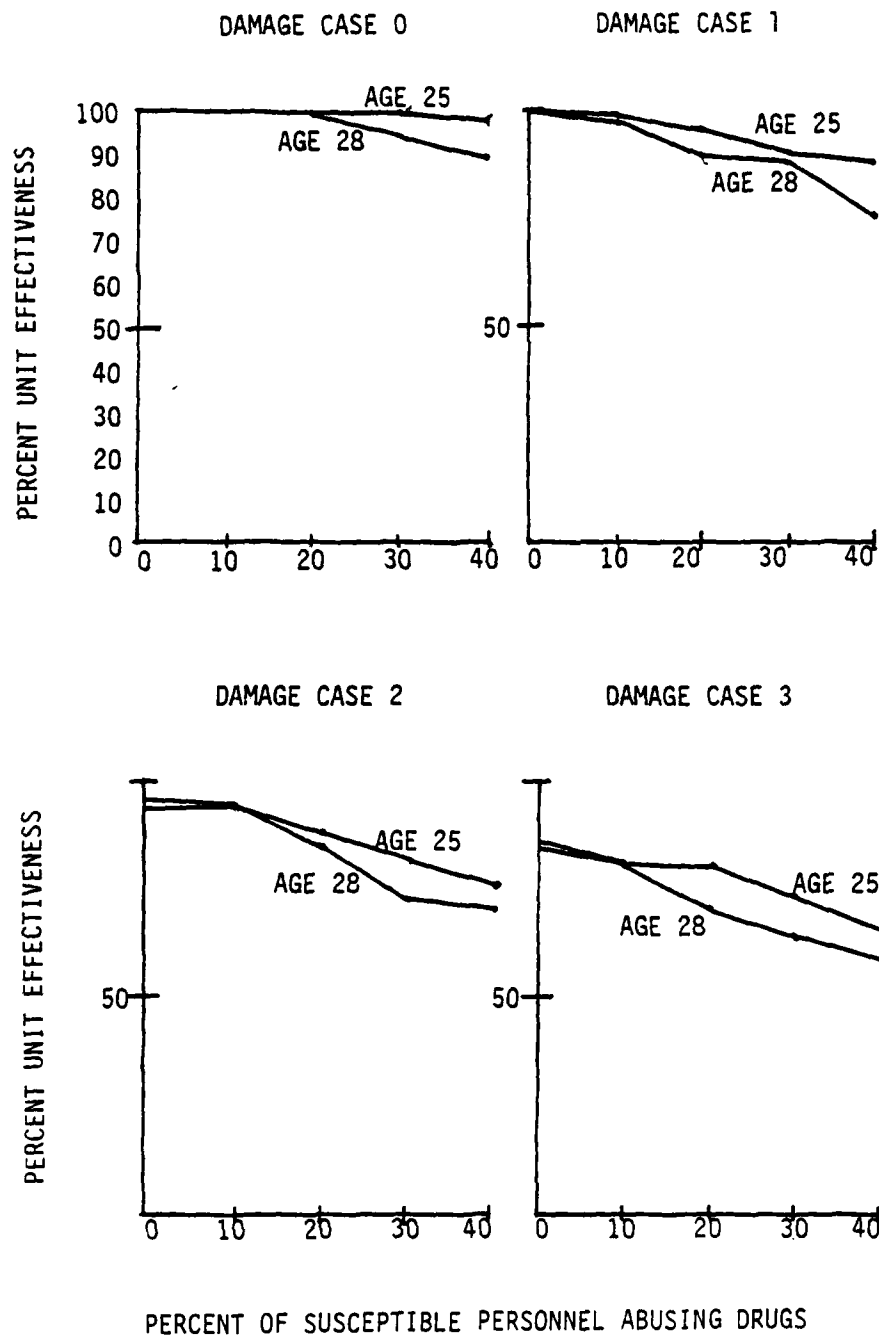


FIGURE 1-2. COMPARISON OF UNIT EFFECTIVENESS BY DAMAGE CASE, HEADQUARTERS COMPANY, INFANTRY BATTALION. AGE 25 VS AGE 28 AS THRESHOLD FOR DRUG ABUSE AVOIDANCE.

SECTION III

OBSERVATIONS AND FUTURE CONSIDERATIONS

This analysis of support and service units covers examination of most of the type divisional units found in armored and mechanized divisions in Europe. As found in the combat-unit analysis discussed in the basic report, the support and service companies are also uniquely affected by similar levels of drug abuse. For example, a ten percent drug-abuse level poses a potentially much greater risk to combat effectiveness in a supply and service company than in a combat engineer company. Results of this analysis also indicate which units are most likely to lose the greatest percent of effectiveness from increased drug abuse. Again, the supply and service company is at the greatest risk.

As noted in the basic report, the reader is cautioned to recognize the limitations of this study before drawing specific conclusions or recommending specific actions concerning the impact of drug abuse on combat capability. The analytical results herein are valid only in the context that they reflect the underlying assumptions in three key areas. These are: (1) the mission, against which unit effectiveness is measured; (2) proficiency of personnel occupying essential positions; and (3) the distribution of drug abusers among MOS holders as only a function of age.

Throughout this project it has been apparent that the methodology is at hand, appropriate and highly suited for this type of analysis. Results based on statistically accurate input data would provide insights into risks to unit effectiveness that, unlike hypothetical data, could lead to identification of actual problem units and critical personnel, and more accurately define the drug-abuse problem in today's Army.

CHAPTER 2 METHODOLOGY

SECTION I THE PROBLEM

To assist the Army in defining the functional impact of hypothetical distributions of drug abuse on select combat support and combat service support units.

SECTION II TECHNICAL APPROACH

The general methodology used to demonstrate the functional impact of hypothetical distributions of drug abuse on select support and service units is the same as that used for the analysis of combat units and is described in detail in Chapter II of the basic report. The explanation included in this chapter assumes reader familiarity with the AMORE methodology and, to avoid unnecessary repetition, contains only that detail considered necessary for continuity and clarification. This work was performed generally as shown in Figure 2-1 and was conducted in three phases; (1) unit analysis and generation of input data, (2) computer runs, and (3) analysis of the AMORE output.

1. Unit Analysis

Within the framework of a basic combat situation, each unit was analyzed to identify those functions within their organization essential for mission accomplishment. Further refinement to a specific mission for each unit was the basis for selection of personnel functions and items of materiel required to perform these essential tasks. These functions were then grouped into team requirements, each team representing a slice of the unit's overall effectiveness. The composition of these personnel and materiel teams are shown for each unit in their respective chapters. Additionally, transferability for both personnel functions and materiel items was determined, as well as times required for these transfers. Times required to repair lightly and moderately damaged equipment were also determined.

The times indicated below were standardized for all units analyzed in this study.

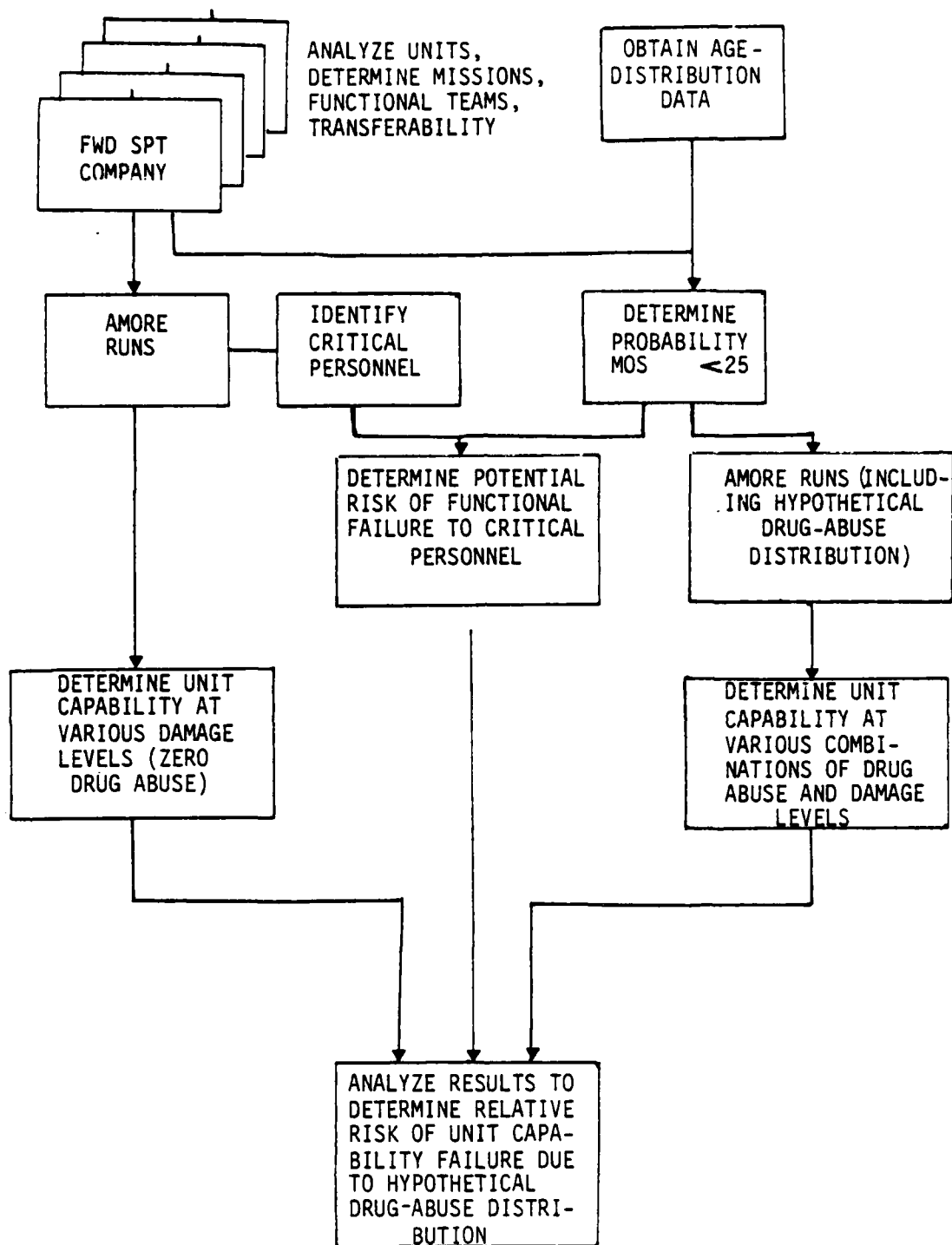


FIGURE 2-1. TECHNICAL APPROACH

<u>EVENT</u>	<u>TIMES</u>
Commander's decision to:	
Transfer personnel	20 Minutes
Transfer equipment	10 Minutes
Repair Equipment	
Light damage (operator repairable)	18 Minutes
Moderate damage (unit repairable)	240 Minutes

It was assumed that drug abuse was casualty-producing in order to determine the maximum risk of functional failure in different units. That is, drug abuse was input in the AMORE methodology as a casualty producer. In the combination of the two casualty probabilities (combat and drug abuse), independent probabilities were assumed. A soldier could be a casualty from drugs or conventional munitions. The calculation of the resultant probability for each MOS is demonstrated by the following example: central office repairman, MOS 36H2, forward support company, maintenance battalion has a probability of .394 of being less than twenty-five. In a unit that has a drug abuse level of .20 he has a probability of $(.394 \times .20) = .079$ of being a drug casualty. At Damage Case 2, he also has a probability of .20 that he will be a casualty from combat damage. Thus, his overall probability of functional failure is: $(\text{Combat}) + (\text{Drugs}) - (\text{Combat}) \times (\text{Drugs}) = .20 + .079 - (.079 \times .20) = .263$. Subtraction of the product $(\text{Combat}) \times (\text{Drugs})$ adjusts the resultant probability to reflect the fact that he can be lost to the unit only one time. The probability of an MOS being occupied by a soldier less than twenty-five years of age was determined from age-distribution data furnished by the U. S. Army Military Personnel Center.

Damage to equipment was considered by applying probabilities of damage to major items of equipment appropriate for each specified level of personnel casualty. These probabilities were calculated from current Joint Munitions Effectiveness Manuals, and are specified in each unit chapter.

2. Computer Runs

Using the above data as input, computer runs were conducted sampling each unit's effectiveness under various damage combinations. Combat damages were considered for zero casualties (Damage Case 0) and for loss rates of ten percent (Damage Case 1), twenty percent (Damage Case 2), and thirty percent (Damage Case 3). First, runs were made considering combat damage only, to examine unit overall ability to reconstitute mission-essential teams and identify personnel critical to reconstitution. Then, drug-abuse probabilities were applied to the unit's personnel functions, assuming various levels (from zero percent to forty percent) of drug abuse in the unit. Only those personnel susceptible to drug abuse are considered in these percentages. The combinations of combat damage and drug-abuse levels used for these runs are shown in the Table 2-1. Fifty iterations were run for each of the nineteen situations to ensure statistical convergence of the output.

TABLE 2-1. COMBAT AND DRUG-ABUSE DAMAGE COMBINATIONS
EXAMINED FOR EACH COMPANY-SIZE UNIT

Combat Damage Case	Drug-Abuse Levels				
	0	.10	.20	.30	.40
0		X	X	X	X
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X

3. Analysis

The output of the damage runs was analyzed to determine the cause of limited unit effectiveness and to assess the relative risk among units to functional failure due to drug abuse. Personnel skills were identified as to their relative criticality to unit reconstitution following combat losses. The impact of additional

losses from drug abuse in those skills previously identified as critical was also assessed from analysis of the output.

Unit Effectiveness. Unit effectiveness was defined as the number of teams the unit could form at any given time and expressed as a percentage of the maximum number of teams. For example, the combat engineer company was organized into nine teams for analysis purposes (each team was built around the engineer squad). If, due to losses, the unit could form only six teams, the unit would be reported as sixty-seven percent effective. Both equipment and personnel are considered in evaluating unit effectiveness. The differences among units in combat effectiveness following losses from drug abuse is a measure of their relative risk to failure from drug abuse.

A convenient ratio was developed to represent unit tolerance to increased drug abuse and is a measure of a unit's ability to sustain its effectiveness in a drug-abuse environment. It is defined as the ratio of percent personnel effectiveness lost to percent increase in drug abuse. A higher ratio indicates a lower tolerance to drug abuse. For example, a unit that experienced a loss of twenty percent in effectiveness when the incidence of drug abuse increased by forty percent would have a tolerance ratio of .50. Another unit may lose thirty percent in effectiveness for an increase in drug abuse of ten percent. That unit's tolerance ratio is 3.00.

Critical Personnel. The model determines which personnel functions could not be filled during each iteration and records the average shortages for all runs. These shortages are analyzed to determine which functions caused the model to "choke" as it tried to build the maximum number of teams. For example, the engineer company may have been capable of forming only five teams because of a shortage of squad leaders. The model would indicate that six teams could not be built from the survivors and would identify the squad-leader function as causing this choke at team six. The average number of times this skill was short would also be shown. The squad-leader function is now considered critical to the unit's ability to reconstitute mission capability. By sampling the unit at several damage levels, the number of times a particular function caused the model to choke can be used to rank those essential functions in terms of criticality. The more frequently the model chokes on a particular function, the more critical the function is to the unit. The importance of a particular function to a unit is also indicated by where in the team build the function is called for. Functions that are required in all teams are more important than those not needed until the last team. An algorithm was used to quantify these factors and rank the personnel functions.

SECTION III

STATEMENT OF WORK

The following tasks were performed in the conduct of this analysis.

- The organizational structure and capability of each type unit were analyzed to determine mission-essential functions and requirements for personnel and equipment.
- Input data were prepared for use in "Analysis of Military Organizational Effectiveness" (AMORE) methodology. Age-distribution data were used to determine the probability of personnel being susceptible to drug abuse and were assumed to equal the probability of being less than twenty-five years of age.
- Units were analyzed to determine combat capabilities before and after combat damage to establish a base-case capability, and identify personnel functions critical to unit effectiveness. Assumed drug-abuse levels of .10%, .20%, .30% and .40% were applied to each unit to determine this impact on unit capability and the identification of critical personnel.
- Results of the AMORE runs were documented and analyzed, yielding a direct comparison of the relative risk among the units examined to functional failure due to drug abuse, and personnel critical to unit effectiveness were identified.
- Headquarters Company, Infantry Battalion (Mech), was examined assuming the probability of being susceptible to drug abuse was equal to the probability of being less than twenty-eight years of age. Results were compared to previous findings which assumed an age threshold of twenty-five.

CHAPTER 3 FORWARD SUPPORT COMPANY

SECTION I GENERAL

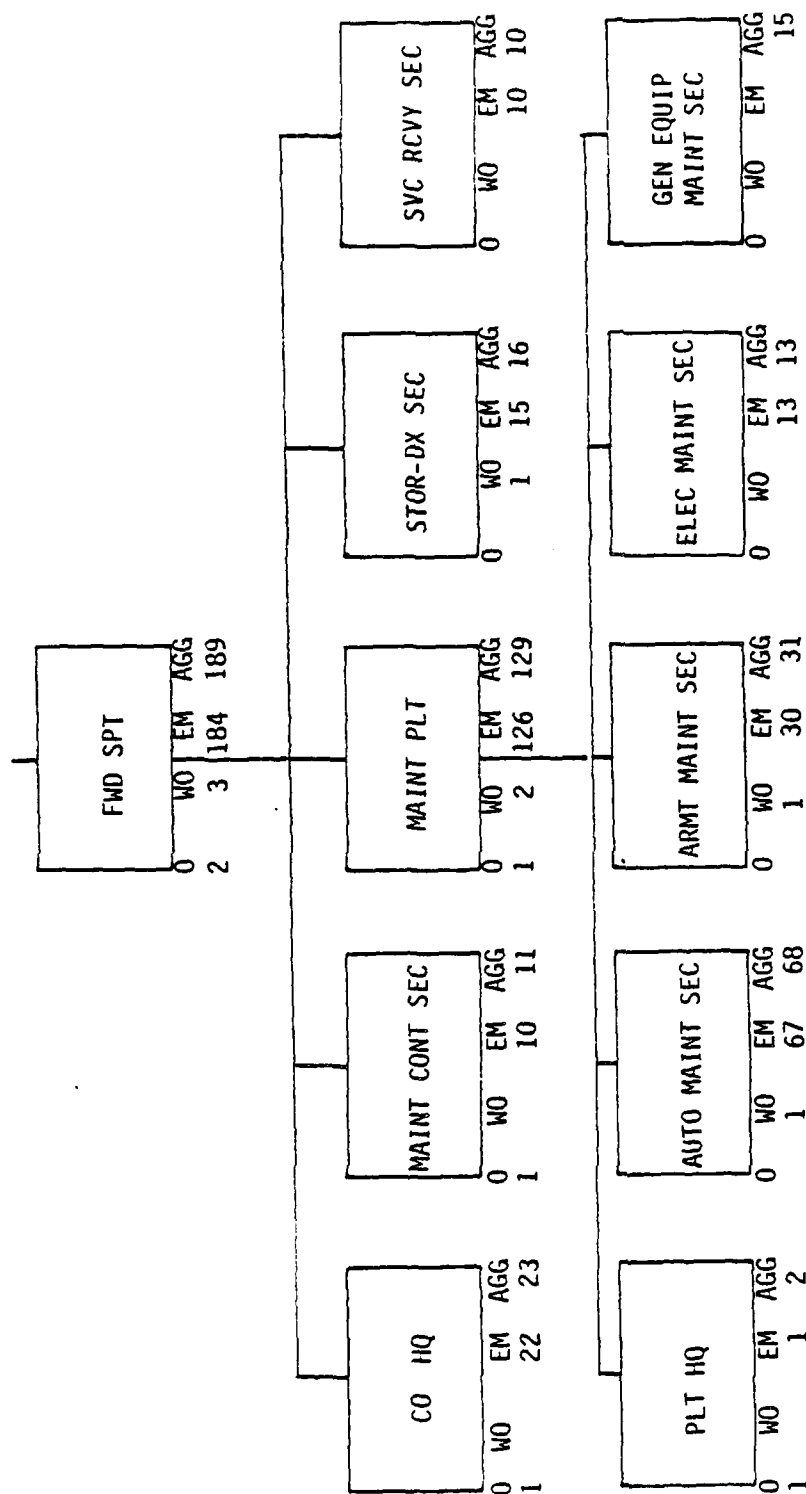
The forward support company of the divisional maintenance battalion provides maintenance support to the combat units of the division. Each company is normally tasked to support one of the three combat brigades of the division by providing direct maintenance and repair-parts supply in the following areas:

- Metal working
- Power generator equipment
- Quartermaster heavy equipment
- Automotive
- Engineer equipment
- Fire control equipment
- Small arms
- Tank turret
- Artillery
- Radar
- Electrical/electronic devices
- Communication equipment
- Chemical equipment

Additionally, the forward support company provides a limited recovery/evacuation capability and repair-parts supply support to units of the brigade.

The forward support company is organized as shown in Figure 3-1, into a maintenance control section; storage direct-exchange section, service recovery section, and a maintenance platoon which is the principal operating unit of the company.

The functional capability of the forward support company is measured against the type of unit it is required to support, in terms of equipment densities. A company supporting an infantry heavy brigade would require a different capability than a company supporting a tank heavy brigade. Each unit requires skills in different



COMBAT MISSION

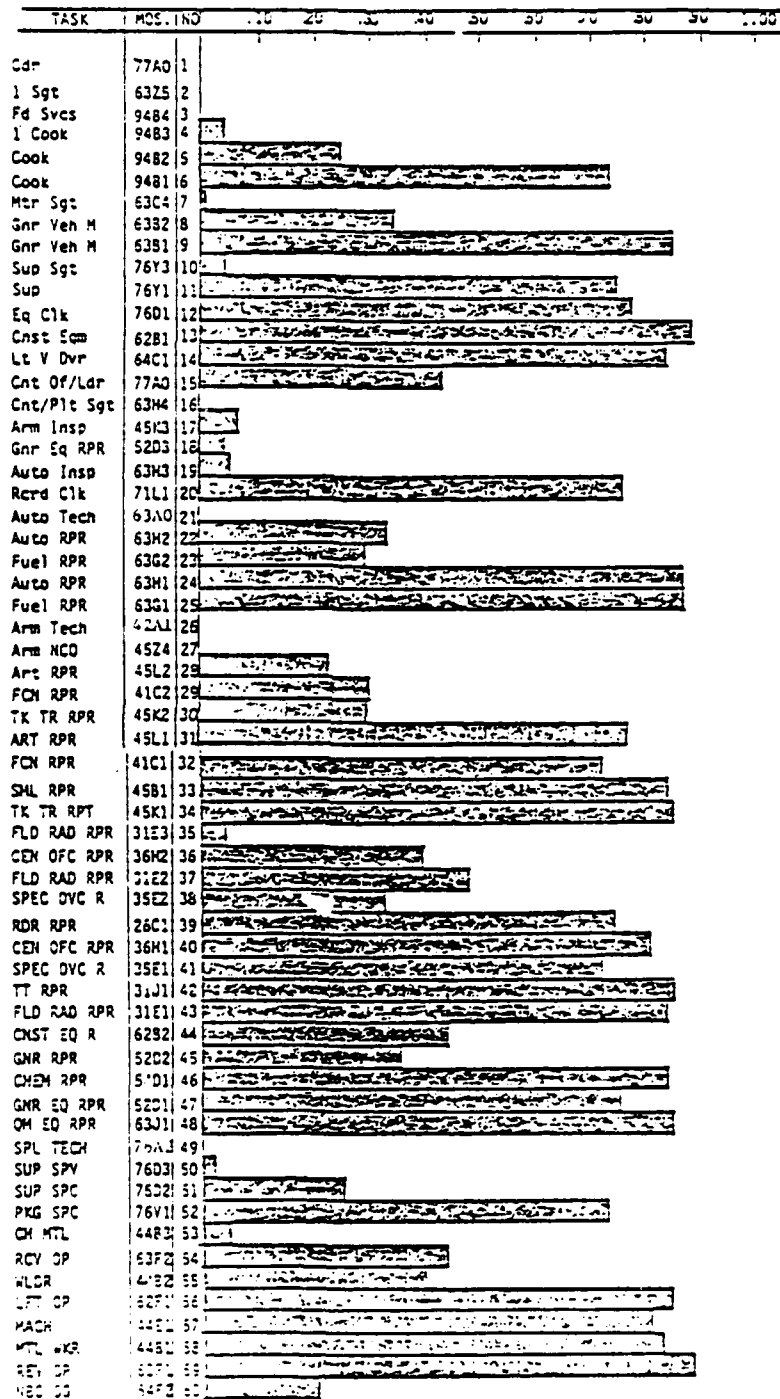
To provide direct support maintenance and repair-parts supply support for mechanical, armament, communications, and construction equipment to units of the brigade in an armored division.

ANALYSIS MISSION

To provide direct support maintenance and repair-parts supply support for a brigade of one artillery battalion, two tank and two infantry battalions

FIGURE 3-1. FORWARD SUPPORT COMPANY, MAINTENANCE BATTALION, ARMORED DIVISION, TOE 29-037H0, CH27

TABLE 3-1. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, FORWARD SUPPORT COMPANY.



quantities. For this analysis the measure of effectiveness is how well the company can support a nominal brigade (armored division) consisting of one artillery battalion, two tank battalions and two infantry battalions.

Table 3-1 lists the key personnel functions identified in this unit. All unique MOS's have been preserved in the sixty separate tasks found in this company. The length of the bar to the right of each task is a visual measure of the probability an individual assigned to that MOS is under twenty-five. Sixty four percent of the total population of this unit would be expected to be less than twenty five. The line number shown for each task is used as a reference for all the figures and tables throughout this chapter.

Collateral damage to equipment that would be expected for the assumed personnel casualty levels was determined by considering damage from conventional munitions, and is shown in Table 3-2. The probability of damage to equipment is shown as light (operator repairable), moderate (unit repairable) and severe (cannot be repaired).

TABLE 3-2. EQUIPMENT DAMAGE PROPERTIES

PERSONNEL CASUALTY LEVEL	EQUIPMENT DAMAGE PROBABILITY		
	LIGHT	MODERATE	SEVERE
.10	.10	.02	.03
.20	.20	.04	.05
.30	.10	.05	.06

SECTION II TEAMS AND TRANSFER MATRICES

The company was divided into eight teams, each representing an equal increment of capability to perform its mission. If personnel are present to perform the function required for all eight teams, the unit is one hundred percent capable of supporting the combat units of the brigade. The assignment of MOS functions to these teams is shown in Figure 3-2. These numbers are cumulative. Only one commander (No. 1) is required for one team or for eight teams. An additional equipment clerk, No. 12, 76D10, is required for each additional team formed. Tasks two through ten are primarily required for unit administration and are not necessary for the unit to perform its mission. They may be able to perform other tasks, however, which is reflected in the transfer matrix at Figure 3-3. In Figure 3-3 the personnel functions are listed by task number vertically from top to bottom and across the top from left to right. The entries in this matrix reflect the time, in minutes, for a task (horizontal row) to assume a function (vertical column). For example, it would take a motor sergeant, (63C4, Nr. 7) sixty minutes to assume the function of the first sergeant (63Z5, Nr. 2). No entry of a time indicates transferability is not allowed.

In Figure 3-4, the cumulative team requirements for materiel are shown. The items of equipment must correspond to the personnel requirements to reflect the total team requirement. Equipment operators needed for team four must also have that equipment at team four in order to perform their function. The materiel transfer matrix is shown at Figure 3-5 and is read the same way as the personnel transfer matrix. Note that while an electric shop van (#29) can substitute for an electrician tool kit (#23) in zero time, the opposite is not true.

The AMORE methodology accepts these teams, matrices, and damage probabilities as input. Shortages from combat and drug abuse are assessed as discussed in Chapter II, and the remaining personnel and equipment are reassigned to reconstitute the maximum capability in the shortest possible time.

TASK	NO	TOE	1	2	3	4	5	6	7	8
COMMANDER	1	1	1	1	1	1	1	1	1	1
FIRST SGT	2	1								
FOOD SVC 5	3	1								
FIRST COOK	4	1								
COOK 2	5	1								
COOK 1	6	3								
MOTOR SGT	7	1								
PG & WV MECH-5	8	2								
PG & WV MECH-4	9	5								
SUPPLY SGT	10	1								
GEN SUPPLY	11	2								
EG CLK/MAT SP	12	12	2	3	4	5	7	8	9	10
CONST EQ MECH	13	3					1	1	1	1
LT VEH OVR	14	3	2	2	2	2	2	2	2	2
NCO/PLT LDR	15	2	1	1	1	1	1	1	1	1
NCS/PLT SGT	16	3								
ARM MNT INSP	17	1	1	1	1	1	1	1	1	1
PWR GEN REP-6	18	2	2	2	2	2	2	2	2	2
AUTO TECH INS	19	3	1	1	1	1	1	1	1	1
RECORD CLERK	20	1								
AUTO REP WO	21	1	1	1	1	1	1	1	1	1
AUTO REP NCO	22	12	2	3	5	6	8	9	11	12
FUEL/ELEC NCO	23	2	1	1	1	1	1	1	1	1
AUTO REP-4	24	47	5	10	15	20	25	30	35	40
FUEL/ELEC REP	25	5	1	1	2	2	3	3	4	4
ARM MAT WO	26	1	1	1	1	1	1	1	1	1
ARM MAT NCO	27	1								
ART REP-5	28	1	1	1	1	1	1	1	1	1
FIRE CON IN-5	29	1	1	1	1	1	1	1	1	1
TANK TUR NCO	30	5	1	1	2	3	3	4	5	5
ART REP-3	31	3			1	1	1	2	2	2
FIRE CON IN-4	32	3			1	1	1	2	2	2
SM ARM REP	33	2	1	1	1	1	1	1	1	1
TANK TUR RP 1	34	14	1	1	2	4	6	8	10	12
FLD RAD RP-5	35	1	1	1	1	1	1	1	1	1
C/M CEN OFC	36	1	1	1	1	1	1	1	1	1
FLD RAD REP-5	37	1	1	1	1	1	1	1	1	1
SP ELEC DEV-5	38	1	1	1	1	1	1	1	1	1
CBT ASR RP	39	1								
DMCOR 1	40	1								
SP ELEC DEV-4	41	5	1	1	2	3	3	4	4	5
TELETYP REP	42	1								
FLD RAD REP-4	43	1								
CONST EQ REP-5	44	1	1	1	1	1	1	1	1	1
PUR GEN REP-5	45	2	1	1	1	1	1	1	1	1
CHEM EQ REP	46	1								
PWR GEN REP-4	47	5			1	1	2	2	3	3
QM EQ REP	48	3								
SPT SUP WO	49	1	1	1	1	1	1	1	1	1
MAT SUP SGT	50	1	1	1	1	1	1	1	1	1
MAT SUP SP	51	3	1	1	1	1	2	2	2	2
PAC/CRAT	52	1	1	1	1	1	1	1	1	1
SEC CH/MET	53	1	1	1	1	1	1	1	1	1
REC VEH OPR	54	1	1	1	1	1	1	1	1	1
WELDER 11	55	1								
LFT/LD OPR	56	1								
MACHINIST	57	1								
METAL WRK	58	2	1	1	1	1	1	1	1	1
REC VEH OPR	59	3	1	1	1	1	2	2	2	2
NBC OPS 11	60	1								

FIGURE 3-2. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, FORWARD SUPPORT COMPANY.

	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1
2
3
4
5
6
7
8	.	.	.	15	30	.	0	.	.	.	.	.	15	.	.	.	.	0	.	.
9	30	.	.	.	.	.	30	.	.	.	.	15	.	.
10	60	30	15	.	.	.	.	.	.	.	.	.	.
11	30	.	.	.	.	.	.	.	.	.
12	10	15	.	.	.	.	.	.	.	.
13	.	.	.	15	.	.	.	.	.	.	.	.	30	.	15	.	.	15	.	.
14
15
16
17
18
19	.	.	.	15	0	.	.	.	.	.	.	.	15	.	.	.	.	.	.	.
20
21	0	.	.	.	.	.	.	.
22	.	.	.	30	15	.	0	.	.	.	.	.	15	.	.	30	.	0	.	.
23	15	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
24	.	.	.	60	.	.	.	.	.	.	.	.	10	.	.	.	.	30	.	.
25
26	0	.	.	.	.	.	.	.	.
27
28
29
30
31
32
33
34
35
36
37	.	15	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
38	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
40
41	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
42	.	0	30	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
43	.	30	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
44	.	.	.	0	.	.	.	.	.	.	.	.	.	.	.	15	.	.	.	.
45	0	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
46	0	15	.	.	.	.	.	.	.	.	.	.	.	.	.
47	.	.	.	15	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48	15	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
49	0	0	0	.	.	.	.	.	.	.	.	.	.
50	15	0	0	.	.	.	.	.	.	.	.	.	.
51	30	15	0	0	.	.	.	.	.	.	.	.	.
52	0	.	.	.	.	.	.	.	.	.
53	0	.	.	.	.	.	.	.	.
54	30	0	15	0	.	15	0	.	.
55	15	.	0	.	15	0	.	.	.
56	30	.	0	.	.	15	.	.
57	45	.	0	30	.	.	.
58	30	15	30	0	.	.	.
59	15	.	.	.	0	.	.
60	0	.

FIGURE 3-3. TRANSFER MATRIX, PERSONNEL, FORWARD SUPPORT COMPANY (PAGE 3 OF 3)

EQUIPMENT	NO	TOE	1	2	3	4	5	6	7	8
TRUCK 1/4 T	1	1	1	1	1	1	1	1	1	1
TRUCK U	2	2								
TRUCK CGO	3	1	1	1	1	1	1	1	1	1
TRUCK	4	17	8	8	9	9	10	10	11	11
AUTO SHOP	5	2	1	1	1	1	1	1	1	1
F/E SHOP	6	1	1	1	1	1	1	1	1	1
MAINT	7	1	1	1	1	1	1	1	1	1
HFC SHOP	8	4	1	1	2	2	3	3	4	4
WLDR	9	1	1	1	1	1	1	1	1	1
CONTACT	10	3	2	2	2	2	2	2	2	2
TRUCK TR	11	4	2	2	2	2	3	3	3	3
TRUCK WR	12	2	1	1	1	1	2	2	2	2
CRANE	13	1								
RCV MED	14	1								
TRAILER	15	3	1	1	1	1	1	1	1	1
TRAILER 1.5	16	15	4	4	5	5	6	6	7	7
TRAILER H2O	17	1								
TOOL KIT M	18	84	14	21	30	38	47	55	63	70
TOOL KIT S	19	5	2	2	2	2	2	2	2	2
TOOL KIT F	20	5	2	3	3	4	4	4	5	5
TOOL KIT F/E	21	7	2	2	3	4	4	5	5	6
TOOL KIT T	22	19	3	5	7	10	12	15	16	19
TOOL KIT E	23	10	3	3	4	5	5	7	7	8
TOOL KIT MM	24	2	1	1	1	1	1	1	1	1
TOOL KIT W	25	2	1	1	1	1	1	1	1	1
SHOP EQ I	26	1								
SHOP EQ A	27	2	1	1	1	1	1	1	1	1
SHOP EQ M	28	1								
ELEC SEMI	29	3	1	1	1	1	2	2	2	2
AUTO PART	30	2	1	1	1	1	1	1	1	1
ARM VAN	31	3	1	1	1	1	2	2	2	2
AVLB MAIN	32	1								
TEL TEST	33	2	1	1	1	1	1	1	1	1
GEN	34	16	8	8	9	9	10	10	11	11
AIR COMP	35	3	1	1	1	1	1	1	1	1

FIGURE 3-4. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, FORWARD SUPPORT COMPANY.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
1	0	0	60																																	
2	60	0	60																																	
3	60	0	0	60																																
4	60	0	30	0																																
5					0		30		30	30																										
6					0		0		30																											
7					60	60	0		30																											
8					60	0		0	30																											
9					60			0	60																											
10					60	60	30		60	0																										
11	60								0	60																										
12	60	0							0	0	60	30																								
13									60		0																									
14	30								0	0	60	0																								
15																																				
16					60											0	0	60																		
17																		0																		
18																			0																	
19																				0																
20																					30	0		30												
21																					30	0		60												
22																						0	30	0												
23																						30	30	0											30	
24																						0	30	30	30	0	30									
25																									0											
26																									0	30	30									
27																										0	30									
28																																				
29																																				
30																																				
31																																				
32																																				
33																																				
34																																				
35																																				

FIGURE 3-5. TRANSFER MATRIX, MATERIEL, FORWARD SUPPORT COMPANY

SECTION III

RESULTS

Figure 3-6 is a display of the effectiveness of the forward support company as a function of time for three levels of combat damage considered. After suffering ten percent personnel casualties and equipment damage, the unit was initially totally ineffective. In less than two hours, however, by replacing key personnel and equipment with available assets, the unit has regained over ninety percent of its capability and eventually reaches one hundred percent effectiveness. Twenty percent casualties results in approximately eighty-five percent reconstituted capability but thirty percent casualties reduces effectiveness to less than sixty percent. Note that capability is limited only by personnel (P) in each case.

Personnel functions and equipment whose loss limited the forward support company's ability to function are listed in Figure 3-7. Personnel tasks essential to minimum accomplishment are listed in the first column. These are ranked by criticality based on a detailed analysis of the unit's ability to recover its effectiveness after three levels of combat damage. An "X" indicates the damage level at which a particular function restricted the unit's ability to achieve a higher level of effectiveness.

The armament materiel warrant officer (26) and the tank turret repairman (24) and NCO (30) were critical at all damage levels. In the lower left of Figure 3-7 are listed those personnel functions, not in themselves essential, that were required to substitute for some of the critical personnel. Critical equipment is listed in the lower, right corner of the figure.

Figures 3-8 and 3-9 show the effectiveness of the forward support company following combat damage (four cases) as a function of varying levels of drug abuse. Two horizontal scales are shown. The upper scale is the percent of drug users among those susceptible to drug abuse (less than twenty-five years old). The lower scale is that equivalent percentage of the entire unit population. Thus ten percent of those less than twenty-five years old equates to seven percent of the unit authorized strength. The dotted line indicates the limiting effects of materiel shortages at the various combat damage levels. There is very little materiel damage except at the twenty percent level. There is little effect on unit capability at ten combat damage

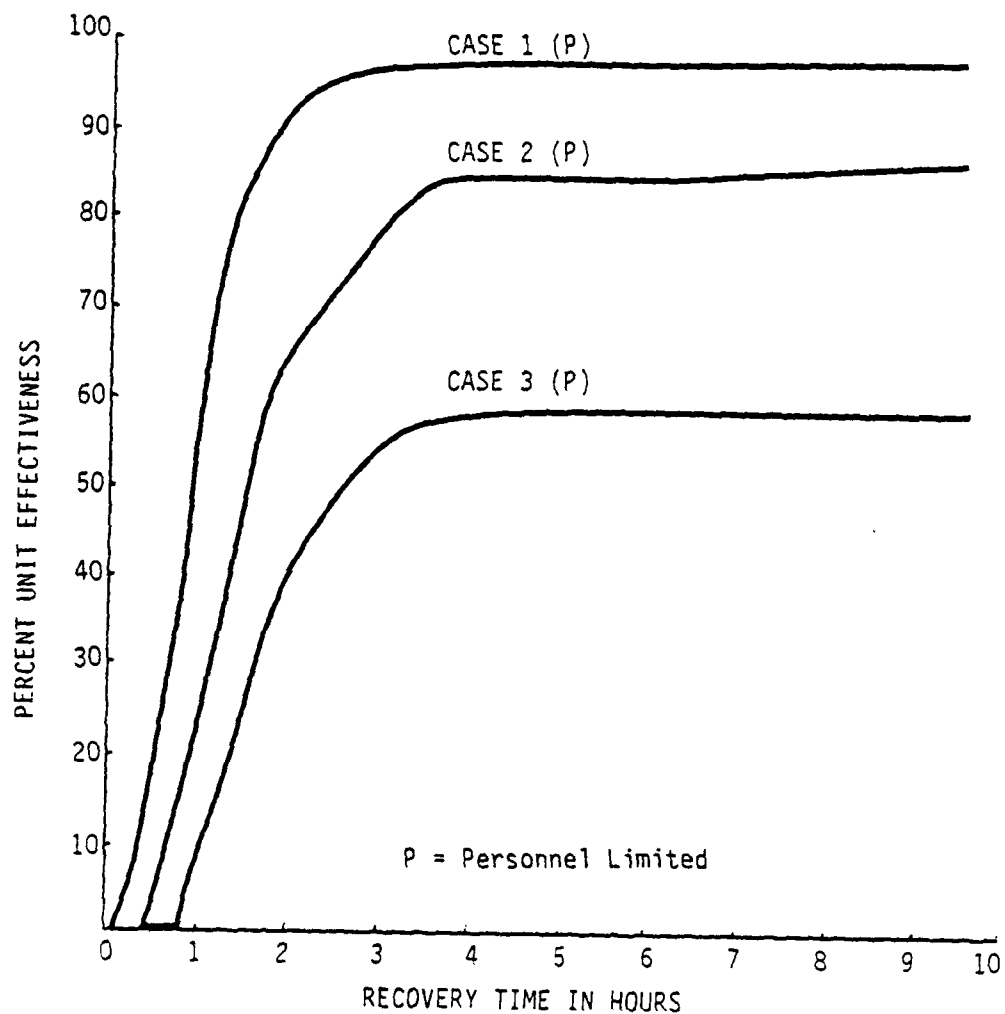


FIGURE 3-6. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, FORWARD SUPPORT COMPANY

BASE CASE

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DAMAGE CASE		
TASK	NO	1	2	3
ARM MAT WO	26	X	X	X
MAT SUP SGT	50	X		
ARM MNT INSP	17		X	X
SP ELEC DEV 5	38		X	X
TANK TUR RP 1	34	X	X	X
TANK TUR NCO	30	X	X	X
FIRE CON IN 5	29		X	X
D/M CEN OFC	36		X	X
ARTILL REP 3	31		X	
ARTILL REP 5	28		X	X
PWR GEN REP 4	47			X
SPT SUPPLY WO	49		X	X
AUTO REP NCO	22		X	X
SP ELEC DEV 4	41		X	X
FLD RAD REP 5	35		X	X
REC VEH OP	54		X	X
FIRE CON IN 4	32			X
FLD RAD REP 5	37			X

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DAMAGE CASE		
TASK	NO	1	2	3
FUEL/ELEC REP	25			X
CONST EQ REP 5	44			X
EQ CLK/MAT SP	12			X
AUTO REP WO	21			X
AUTO REP 4	24	X		X
COMMANDER	1			
PWR GEN REP 6	18			
SEC CH/MET	53			
LT VEH DVR	14			
MCO/PLAT LDR	15			
AUTO TECH INS	19			
FUEL/ELEC NCO	23			
SMALL ARM REP	33			
PWR GEN REP 5	45			
MATER SUP SP	51			
METAL WORKER	58			
REC VEH OPR	59			
CONST EQ MEC	13			

REQUIRED SUBSTITUTES		DAMAGE CASE		
TASK	NO	1	2	3
P.GEN&W.VEH	8	X	X	X
P.GEN&W.VEH	9		X	X
GEN SUPPLY	11	X	X	X
ARM MAT NCO	27	X	X	X
COMBAT ASR	39	X	X	X
TELETYPE REP	42		X	X
FLD RAD REP 4	43		X	X
PACK/CRATING	52			X
LIFT/LOAD OPR	56			X

CRITICAL EQUIPMENT				
TYPE	NO	1	2	3
ELEC SHOP SENT	29			X
ARM SHOP VAN	31			X

FIGURE 3-7. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT FOR VARIOUS CASES OF COMBAT DAMAGE, FORWARD SUPPORT COMPANY

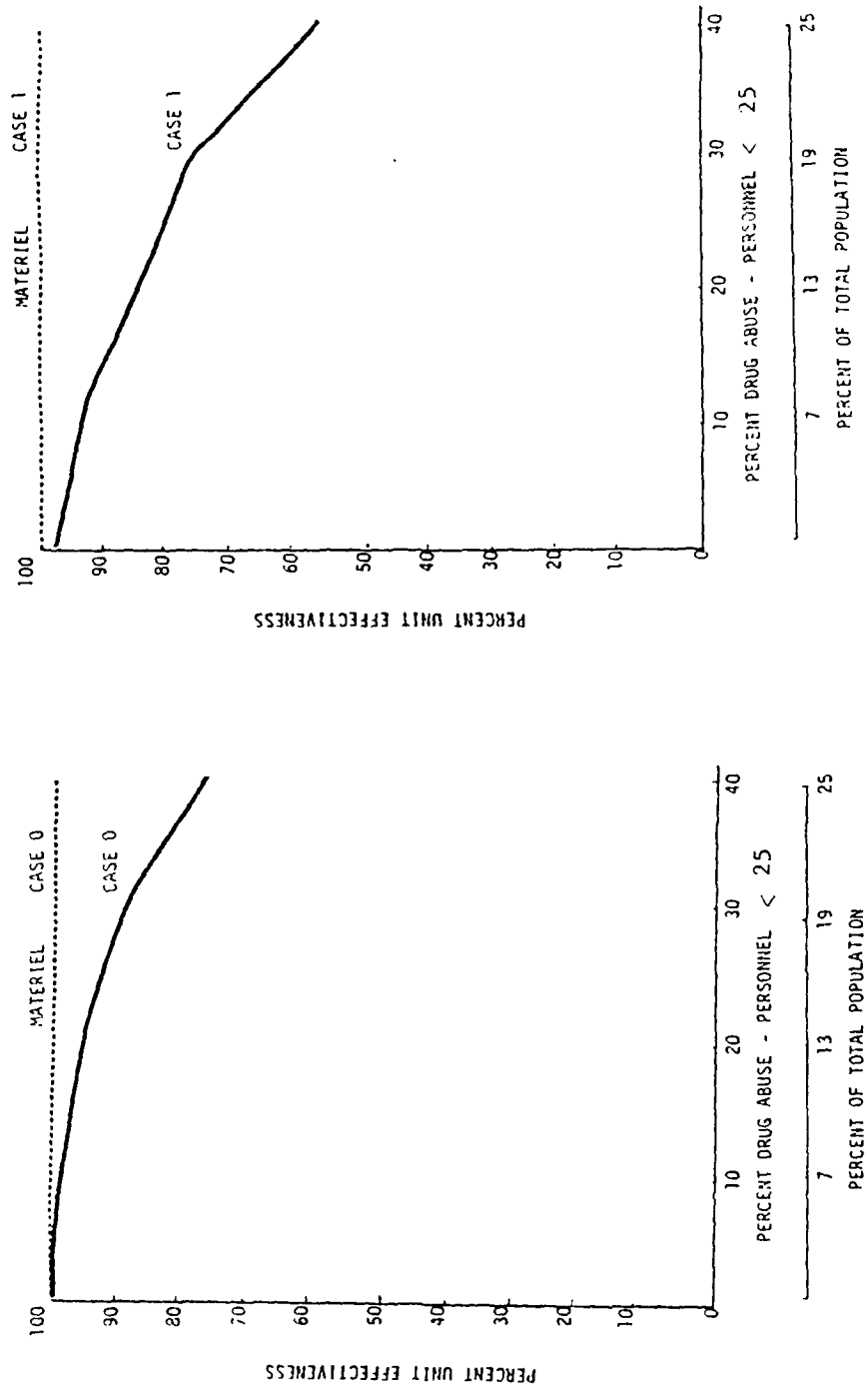


FIGURE 3-8. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 0 AND 1)
AND VARIOUS LEVELS OF DRUG USE, FORWARD SUPPORT COMPANY.

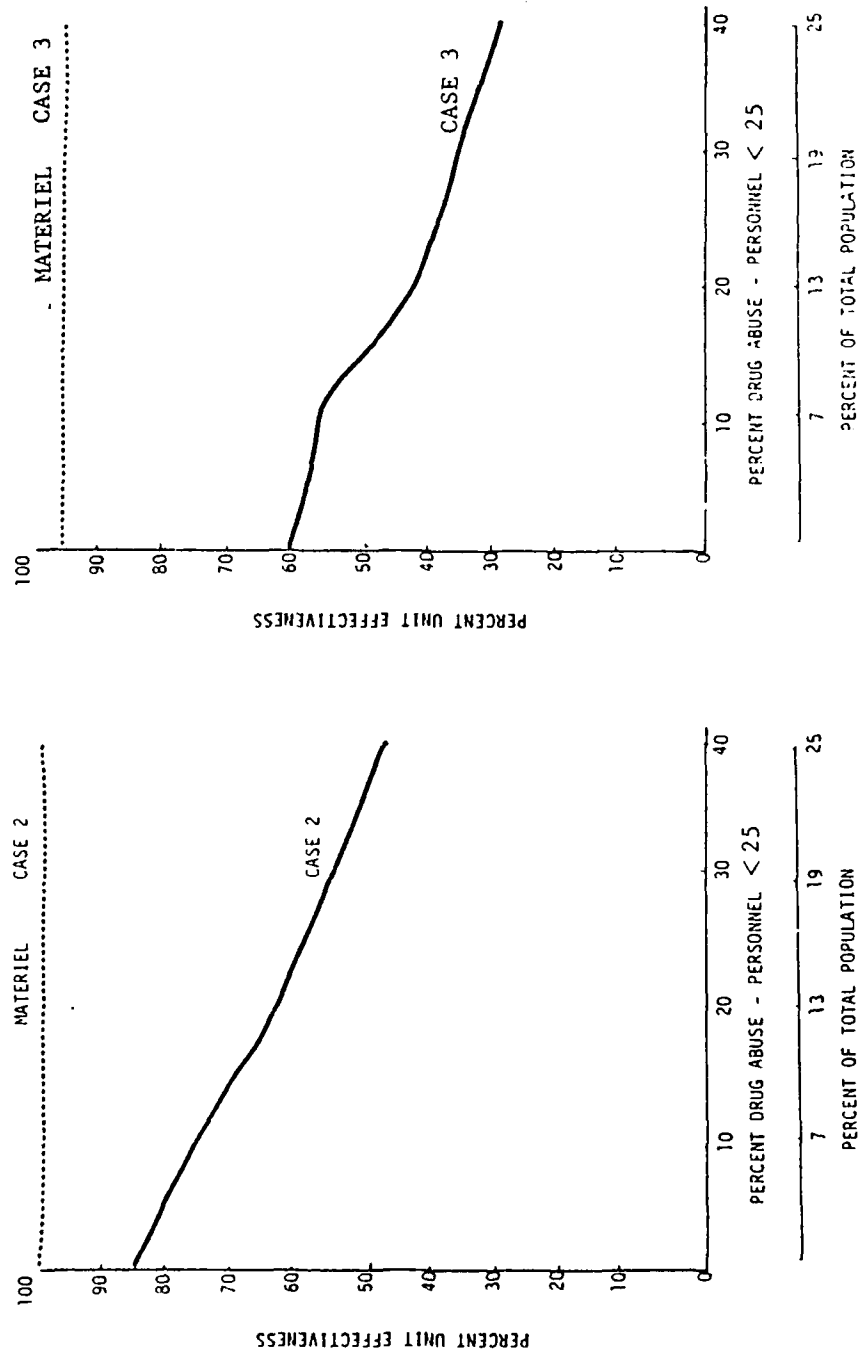


FIGURE 3-9. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 2 AND 3) AND VARIOUS LEVELS OF DRUG USE, FORWARD SUPPORT COMPANY.

(0 drug abuse), but the addition of drug abuse seriously reduces capability. This is quantified in Table 3-3, which shows the tolerance ratios for each combat damage case. The high of .99 at Damage Case 1 represents almost a one-for-one loss of effectiveness to increased drug abuse.

TABLE 3-3. TOLERANCE RATIOS, FORWARD SUPPORT COMPANY

	DAMAGE CASE			
	0	1	2	3
RATIO:	.83	.99	.97	.82

Figures 3-10 through 3-13 show limiting functions in a format similar to Figure 3-7, but the critical personnel are now identified at each level of drug abuse for each of the four damage cases.

The first column lists the same mission-essential personnel ranked previously from combat damage sampling (Figure 3-7). The impact on unit effectiveness of drug abuse when added to combat damage resulted in the addition of seven more personnel functions to the list of those previously identified as critical. They are shown below in Table 3-4, along with the probability of being less than twenty-five years of age.

DAMAGE CASE 0

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
ARM MAT WO	26					
MAT SUP SGT	50					
ARM MNT INSP	17					
SP ELEC DEV 5	38				X	X
TANK TUR PR 1	34			X	X	X
TANK TUR NCO	30				X	X
FIRE CON IN 5	29				X	X
D/M CEN OFC	36		X		X	X
ARTILL REP 3	31					X
ARTILL REP 5	28				X	
PWR GEN REP 4	47					
SPT SUPPLY WO	49					
AUTO REP NCO	22					X
SP ELEC DEV 4	41			X	X	X
FLD RAD REP 5	35					
REC VEH OP	54					
FIRE CON IN 4	32					
FLD RAD REP 5	37					X

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
FUEL/ELEC REP	25				X	X
CONST EQ REP 5	44					X
EQ CLK/MAT SP	12				X	X
AUTO REP WO	21					
AUTO REP 4	24				X	X
COMMANDER	1					
PWR GEN REP 6	18					
SEC CH/MET	53					
LT VEH DVR	14					
NCO/PLAT LDR	15					
AUTO TECH INS	19					
FUEL/ELEC NCO	23					
SMALL ARM REP	33					
PWR GEN REP 5	45					
MATER SUP SP	51					
METAL WORKER	58					
REC VEH OPR	59					X
CONST EQ MEC	13					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO	0	1	2	3	4
P.GEN&W.VEH 5	8			X	X	X
P.GEN&W.VEH 4	9				X	X
GEN SUPPLY	11				X	X
ARM MAT NCO	27			X	X	X
COMBAT ASR	39		X	X	X	X
TELETYPE REP	42		X	X	X	X
FLD RAD REP 4	43			X	X	X
PACK/CRATING	52				X	X

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
NONE						

FIGURE 3-10. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 0), FORWARD SUPPORT COMPANY.

DAMAGE CASE 1

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
ARM MAT WO	26	X		X		X
MAT SUP SGT	50	X				
ARM MNT INSP	17			X	X	X
SP ELEC DEV 5	38		X	X	X	X
TANK TUR RP 1	34	X	X	X	X	X
TANK TUR NCO	30	X	X	X	X	X
FIRE CON IN 5	29		X			
D/M CEN OFC	36		X	X	X	X
ARTILL REP 3	31		X		X	X
ARTILL REP 5	28			X	X	X
PWR GEN REP 4	47					
SPT SUPPLY WO	49				X	
AUTO REP NCO	22			X	X	X
SP ELEC DEV 4	41		X	X	X	X
FLD RAD REP 5	35			X	X	X
REC VEH OP	54				X	X
FIRE CON IN 4	32					X
FLD RAD REP 5	37		X			X

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
FUEL/ELEC REP	25			X	X	X
CONST EQ REP 5	44				X	
EQ CLK/MAT SP	12			X	X	X
AUTO REP WO	21					
AUTO REP 4	24			X	X	X
COMMANDER	1					
PWR GEN REP 6	18					
SEC CH/MET	53					
LT VEH DVR	14					
MCO/PLAT LDR	15					
AUTO TECH INS	19					
FUEL/ELEC NCO	23					
SMALL ARM REP	33					
PWR GEN REP 5	45					
MATER SUP SP	51					
METAL WORKER	58					
REC VEH OPR	59				X	X
CONST EQ MEC	13					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO	0	1	2	3	4
P.GEN&W.VEH	8	X	X	X	X	X
P.GEN&W.VEH	9			X	X	X
GEN SUPPLY	11	X	X	X	X	X
ARM MAT NCO	27	X	X	X	X	X
COMBAT ASR	39	X	X	X	X	X
TELETYPE REP	42		X	X	X	X
FLD RAD REP 4	43		X	X	X	X
PACK/CRATING	52				X	X
LIFT/LOAD OPR	56			X		

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
NONE						

FIGURE 3-11. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), FORWARD SUPPORT COMPANY.

DAMAGE CASE 2

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
ARM MAT WO	26	X	X	X	X	X
MAT SUP SGT	50		X			
ARM MNT INSP	17	X	X	X	X	X
SP ELEC DEV 5	38	X	X	X	X	X
TANK TUR RP 1	34	X	X	X	X	X
TANK TUR NCO	30	X	X	X	X	X
FIRE CON IN 5	29	X	X	X	X	X
D/M CEN OFC	36	X	X	X		X
ARTILL REP 3	31	X		X	X	X
ARTILL REP 5	28	X	X	X		X
PWR GEN REP 4	47			X		
SPT SUPPLY WO	49	X	X	X	X	X
AUTO REP NCO	22	X	X	X	X	X
SP ELEC DEV 4	41	X	X	X	X	X
FLD RAD REP 5	35	X	X	X	X	X
REC VEH OP	54	X	X		X	
FIRE CON IN 4	32		X	X	X	X
FLD RAD REP 5	37		X	X	X	X

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
FUEL/ELEC REP	25					
CONST EQ REP 5	44			X	X	X
EQ CLK/MAT SP	12		X	X	X	X
AUTO REP WO	21					
AUTO REP 4	24	X	X	X	X	X
COMMANDER	1					
PWR GEN REP 6	18					
SEC CH/MET	53					
LT VEH DVR	14					
MCO/PLAT LDR	15					
AUTO TECH INS	19					
FUEL/ELEC NCO	23					
SMALL ARM REP	33					
PWR GEN REP 5	45					
MATER SUP SP	51			X		
METAL WORKER	58					
REC VEH OPR	59				X	X
CONST EQ MEC	13					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO	0	1	2	3	4
P.GEN&W.VEH	8	X	X	X	X	X
P.GEN&W.VEH	9	X	X	X	X	X
GEN SUPPLY	11	X	X	X	X	X
ARM MAT NCO	27	X	X	X	X	X
COMBAT ASR	39	X	X	X	X	X
TELETYPE REP	42	X	X	X	X	X
FLD RAD REP 4	43	X	X	X	X	X
PACK/CRATING	52		X	X	X	X
LIFT/LOAD OPR	56		X	X	X	X

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
NONE						

FIGURE 3-12. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 2), FORWARD SUPPORT COMPANY.

DAMAGE CASE 3

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL					
TASK	NO	0	1	2	3	4	
ARM MAT WO	26	X	X	X	X	X	
MAT SUP SGT	50		X	X	X	X	
ARM MNT INSP	17	X	X	X	X	X	
SP ELEC DEV 5	38	X	X	X	X	X	
TANK TUR RP 1	34	X	X	X	X		
TANK TUR NCO	30	X	X	X		X	
FIRE CON IN 5	29	X	X	X	X		
D/M CEN OFC	36	X	X	X	X	X	
ARTILL REP 3	31		X	X	X		
ARTILL REP 5	28	X	X	X	X		
PWR GEN REP 4	47	X					
SPT SUPPLY WO	49	X	X	X	X	X	
AUTO REP NCO	22	X	X	X	X	X	
SP ELEC DEV 4	41	X	X	X	X	X	
FLD RAD REP 5	35	X	X	X	X	X	
REC VEH OP	54	X	X		X	X	
FIRE CON IN 4	32	X	X	X	X	X	
FLD RAD REP 5	37	X	X	X	X	X	

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL					
TASK	NO	0	1	2	3	4	
FUEL/ELEC REP	25	X	X	X	X	X	
CONST EQ REP 5	44	X	X	X	X	X	
EQ CLK/MAT SP	12	X	X	X	X	X	
AUTO REP WO	21	X					
AUTO REP 4	24	X	X	X	X	X	
COMMANDER	1		X		X	X	
PWR GEN REP 6	18					X	
SEC CH/MET	53					X	
LT VEH DVR	14						
MCO/PLAT LDR	15						
AUTO TECH INS	19						
FUEL/ELEC NCO	23		X			X	
SMALL ARM REP	33					X	
PWR GEN REP 5	45						
MATER SUP SP	51				X	X	
METAL WORKER	58						
REC VEH OPR	59				X	X	
CONST EQ MEC	13						

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS					
TASK	NO	0	1	2	3	4	
P.GEN&W.VEH	8	X	X	X	X	X	
P.GEN&W.VEH	9	X	X	X	X	X	
GEN SUPPLY	11	X	X	X	X	X	
ARM MAT NCO	27	X	X	X	X	X	
COMBAT ASR	39	X	X	X	X	X	
TELETYPE REP	42	X	X	X	X	X	
FLD RAD REP 4	43	X	X	X	X	X	
PACK/CRATING	52	X	X	X	X	X	
LIFT/LOAD OPR	56	X	X		X		

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
ELEC SHO SEMI	29	X				
ARM SHOP VAN	31	X				

FIGURE 3-13. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 3), FORWARD SUPPORT COMPANY.

TABLE 3-4. CRITICAL PERSONNEL FROM COMBAT DAMAGE
AND DRUG ABUSE, FORWARD SUPPORT COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
ARM MAT WO	42A1	0
MAT SUP SGT	76D3	.02
ARM MNT INSP	45K3	.07
SP ELEC DEV 5	35E2	.33
TANK TUR RP 1	45K1	.86
TANK TUR NCO	45K2	.30
FIRE CON IN 5	41C2	.31
D/M CEN OFC	36H2	.39
ARTILL REP 3	45L1	.78
ARTILL REP 5	45L2	.23
PWR GEN REP 4	52D1	.76
SPT SUPPLY WO	76A2	0
AUTO REP NCO	63H2	.32
SP ELEC DEV 4	35E1	.72
FLD RAD REP 5	31E3	.03
REC VEH OP	63F2	.44
FIRE CON IN 4	41C1	.78
FLD RAD REP 5	31E2	.48
FUEL/ELEC REP	63G1	.87
CONST EQ REP 5	62B2	.44
EQ CLK/MAT SP	76D1	.79
AUTO REP WO	63A0	.32
AUTO REP 4	63H1	.87

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
COMMANDER	77A0	0
PWR GEN REP-6	52D3	.04
SEC CH/MET	44B3	.06
FUEL/ELEC NCO	63G2	.31
SMALL ARM REP	45B1	.84
MATRL SUP SP	76D2	.26
REG VEH OPR	63F1	.90

CHAPTER 4

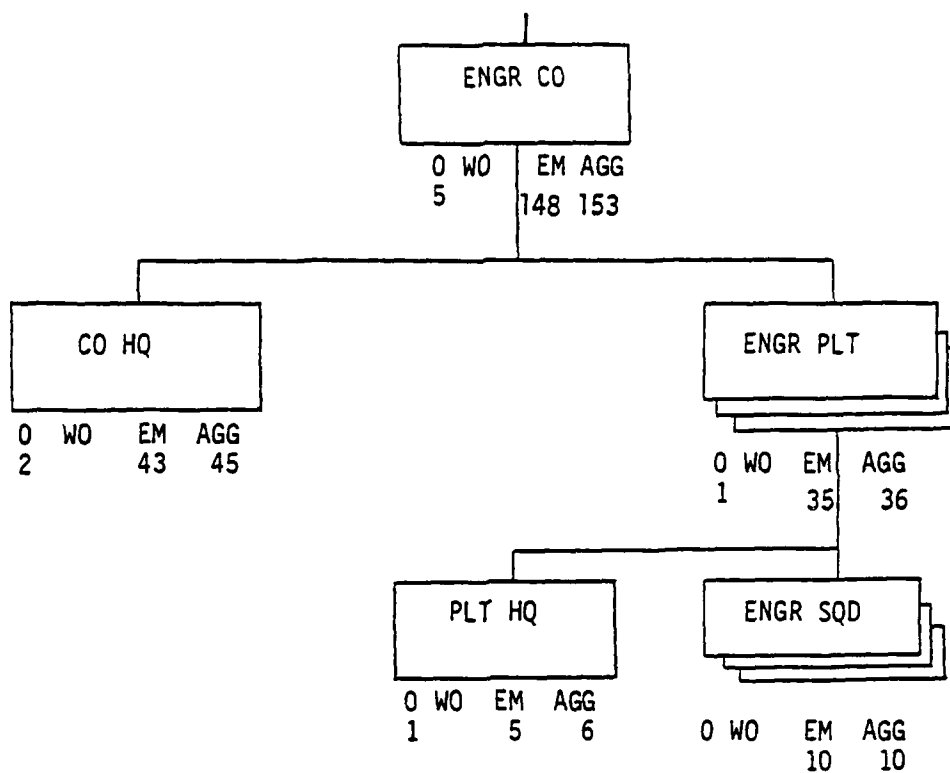
COMBAT ENGINEER COMPANY

The combat engineer company of the division engineer battalion provides engineer support to the combined arms team of the division. Typically, an engineer company supports one of the brigades of the division. The unit analyzed herein is one of the three organic combat engineer companies of the engineer battalion, infantry division (mechanized). The company is organized as shown in Figure 4-1. Command and control, some maintenance and supply, and special equipment support such as the combat engineer vehicle (CEV) are provided by the company headquarters section. The three engineer platoons form the operational backbone of the company. Each platoon has three squads of demolition and construction specialists. The squads and platoons are augmented with additional equipment, when necessary, from the company headquarters.

The functional capability of the combat engineer company is measured against the number of engineer squads it can form from existing assets to provide the combat engineer support required over a short period of time (twenty-four hours) by one of the brigades of a mechanized infantry division engaged in intensive armor combat.

The personnel functions identified from analysis of the TOE are listed in Table 4-1. A total of forty-five unique tasks was identified and is shown by MOS. Each task is numbered for future reference in figures and tables throughout the chapter. The bar graph to the right of each task is a visual display of the probability that MOS is occupied by someone less than twenty-five years of age. Of the 153 authorized, sixty-six percent are expected to be less than twenty-five years old.

Collateral damage to equipment that would be expected for each of the assumed levels of personnel losses was determined by considering damage from conventional-weapon attack and is shown in Table 4-2. The probability of damage to equipment is shown as light (operator repairable), moderate (unit repairable), and severe (cannot be repaired).



COMBAT MISSION

To provide combat engineer support for combined arms teams of the armored and infantry (mechanized) divisions.

ANALYSIS MISSION

To provide combat engineer support to a mechanized infantry brigade defending against a tank heavy force in an intensive combat situation for a short period of time (24 hours).

FIGURE 4-1. COMBAT ENGINEER COMPANY, ENGINEER BATTALION, ARMORED AND INFANTRY (MECHANIZED) DIVISION. TOE 5-147H4, CH2.

TABLE 4-1 PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, COMBAT ENGINEER COMPANY.

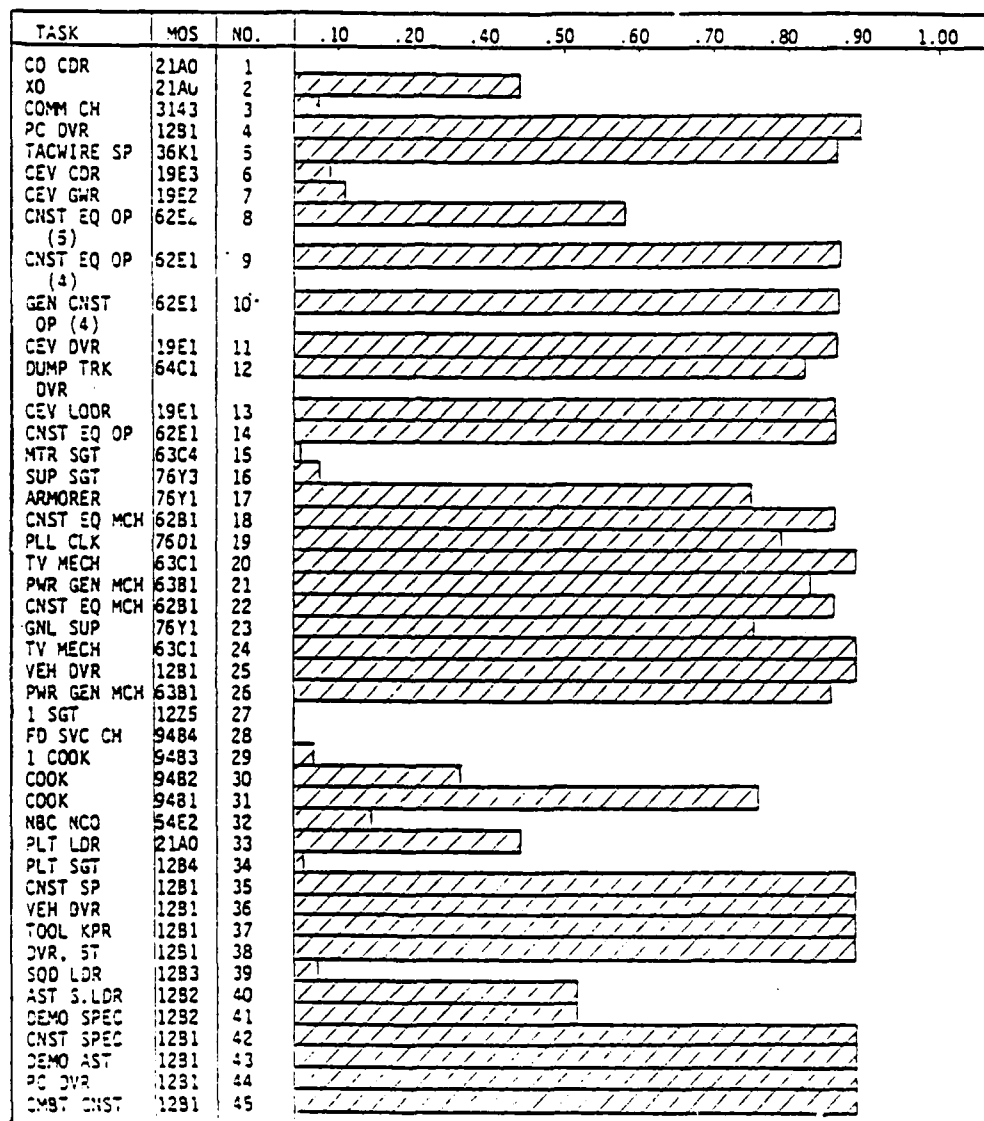


TABLE 4-2. EQUIPMENT DAMAGE PROBABILITIES

PERSONNEL CASUALTY LEVEL	EQUIPMENT DAMAGE PROBABILITY		
	LIGHT	MODERATE	SEVERE
.10	.10	.03	.04
.20	.20	.06	.07
.30	.30	.09	.10

SECTION II

TEAMS AND TRANSFER MATRICES

The engineer company was organized into nine teams for analysis purposes. Each team is built around the engineer squad with successive teams adding an equal increment of unit capability. Command and control and required support functions are added to reflect their contribution to the overall unit capability to perform its specified mission. A unit capable of forming nine teams of personnel and equipment is considered to be one hundred percent effective. The assignment of MOS functions to these nine teams is shown cumulatively in Figure 4-2. Thus, to form four teams (forty-four percent effective) requires one commander, CEV commander, gunner, driver, five equipment construction operators and a dump-truck driver from the headquarters section. Two personnel functions are required from the maintenance section and sufficient personnel to form the nucleus of two platoon headquarters and four squads. Note that the CEV loader is not considered essential for CEV operations in this situation. Similarly, cooks and other maintenance and supply functions are not considered mission essential.

Which functions are substitutable are shown in the personnel transfer matrix at Figure 4-3. Personnel functions are listed by task number vertically from top to bottom and horizontally across the top. Entries in the matrix indicate the time required for each function in the first column to assume the tasks along his row. For example, task nine (construction equipment operator, 62E1) in the left hand column can assume any functions in his row where there is an entry. Number nine can assume the role of dump truck driver (number twelve) in ten minutes, but he cannot be a CEV commander, 19E3 (number six) which is a different career field.

Figure 4-4 shows the cumulative team requirements for material which must correspond to the personnel team requirements. The second CEV is required at Team five as is the second CEV crew (Figure 4-2). There is also a transfer matrix for materiel (Figure 4-5) which is read in the same manner as the personnel transfer matrix. Note the uniqueness of some of the equipment. The back hoe (six) has no substitute, nor can it be used satisfactorily for any other piece of equipment. The AMORE methodology accepts these teams, matrices and damage probabilities as input. Shortage of enlisted personnel and equipment are assessed as discussed in Chapter II and the model reassigns available personnel and equipment to reconstitute the maximum number of teams in the shortest possible time.

TASK	NO	TOE	1	2	3	4	5	6	7	8	9
CO COMMANDER	1	1	1	1	1	1	1	1	1	1	1
CO	2	1									
COMM CHIEF	3	1									
PERS CARR DVR	4	1									
TAC WIRE SP	5	1									
CEV COMMANDER	6	2	1	1	1	1	2	2	2	2	2
CEV GUNNER	7	2	1	1	1	1	2	2	2	2	2
CONST EQ OP-3	8	3	1		1	2	2	2	3	3	3
CONST EQ OP-4	9	2	1	1	1	1	1	1	1	1	1
GENL CONST OP-4	10	1									
CEV DRIVER	11	2	1	1	1	1	2	2	2	2	2
DUMP TRK DVR	12	1									
CEV LDR	13	2									
CONST EQ OP-4	14	3	1	1	1	2	2	2	3	3	3
MOTOR SGT	15	1									
SUP SGT	16	1									
ARMORER	17	1									
CONST EQ MH-4	18	1									
PLL CLERK	19	1									
TV MECH-4	20	1									
PGEN MECH-4	21	1									
CONST EQ MECH-3	22	1									
GENL SUP	23	1									
TV MECH-3	24	2									
VEH DWR-3	25	1									
PGEN MECH-3	26	2									
1 SGT	27	1									
FD SVC CH	28	1									
1 COOK	29	1									
COOK-5	30	1									
COOK 4/3	31	3									
NBC WCO	32	1									
PLATOON LEADER	33	3	1	1	1	2	2	2	3	3	3
PLATOON SGT	34	3									
CONST SPEC-4	35	3	1	1	1	2	2	2	3	3	3
VEH DRIVER-4	36	3	1	1	1	2	2	2	3	3	3
TOOL RM KEEPER	37	3									
5 TON DRIVER	38	3	1	1	1	2	2	2	3	3	3
SQUAD LDR	39	9	1	2	3	4	5	6	7	8	9
ASST SQD LDR	40	9									
DEMO SPEC	41	9	1	2	3	4	5	6	7	8	9
CONST SPEC-4	42	27	2	4	6	8	10	12	14	16	18
DEMO ASST	43	9	1	2	3	4	5	6	7	8	9
PERS CARR DVR	44	9	1	2	3	4	5	6	7	8	9
COMBAT CONST	45	18	1	2	3	4	5	6	7	8	9

FIGURE 4-2. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, COMBAT ENGINEER COMPANY.

[illegible]

FIGURE 4-3. TRANSFER MATRIX, PERSONNEL, COMBAT ENGINEER COMPANY (PAGE 1 OF 2)

TRANSFER MATRIX FOR PERSONNEL

	01	02	03	04	05
1
2
3
4	.	.	.	0.0	.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25	.	.	.	70.00	.
26
27
28
29
30
31
32
33
34
35	05	10	09	35	33
36	.	15	35	35	30
37	30
38	.	.	.	35	30
39
40
41	0	0	0	.	.
42	.	0	0	.	.
43	15	0	0	0	.
44	.	0	5	0	0
45	.	15	15	15	.

FIGURE 4-3. TRANSFER MATRIX, PERSONNEL, COMBAT ENGINEER COMPANY (PAGE 2 OF 2)

EQUIPMENT	NO	TOE	1	2	3	4	5	6	7	8	9
APC-VRC 46	1	1									
1/4 T-VRC 46	2	1	1	1	1	1	1	1	1	1	1
CEV	3	2	1	1	1	1	2	2	2	2	2
SCOOP LOADER	4	2	1	1	1	1	2	2	2	2	2
BULLDOZER	5	1	1	1	1	1	1	1	1	1	1
BACKHOE	6	1					1	1	1	1	1
CO TOOL KIT	7	1	1	1	1	1	1	1	1	1	1
25 TON LOWBED	8	1									
5 TON DUMP	9	1									
2.5 TON TRK	10	3									
COMPRESSOR	11	1									
GENERATOR	12	1									
AUTO MAINT	13	1									
5/4 T-VRC 47	14	3	1	1	1	2	2	2	3	3	3
PLATOON TOOL KIT	15	3	1	1	1	2	2	2	3	3	3
DEMO KIT	16	3	1	1	1	2	2	2	3	3	3
GENERATOR	17	3									
5 TON DUMP	18	3	1	1	1	2	2	2	3	3	3
APC GRC 160	19	9	1	2	3	4	5	6	7	8	9
DEMO KIT SQ	20	9	1	2	3	4	5	6	7	8	9
SQD TOOL KIT	21	9	1	2	3	4	5	6	7	8	9

FIGURE 4-4. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, COMBAT ENGINEER COMPANY.

TRANSFER MATRIX FOR MATERIAL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 4-5. TRANSFER MATRIX, MATERIEL, COMBAT ENGINEER COMPANY.

SECTION III

RESULTS

Figure 4-6 is a display of the effectiveness of the combat engineer company as a function of time considering only three levels of combat damage. No degradation from drug abuse is assumed. At ten percent personnel casualties (Case 1) the unit can only recover to eighty percent of its original effectiveness. But twenty percent personnel casualties (Case 2) and associated equipment damage significantly reduces unit effectiveness to less than sixty percent. Note that unit capability is limited in each case by materiel shortages (M) rather than by personnel. This results from the lack of substitutability among essential items of equipment. Personnel functions were also critical, if not limiting, and are listed, along with the critical equipment and required substitutes, in Figure 4-7. Personnel functions appear in the first column, ranked by criticality based on a detailed analysis of the unit's ability to recover its effectiveness following losses. The "X" beside certain functions indicates at what damage level they were critical to unit reconstitution. The damage level at which equipment limited unit effectiveness is also shown by an "X" under the appropriate damage case. Personnel functions not in themselves essential, but required to substitute for critical personnel, are shown in the column marked "required substitutes."

The impact of drug abuse on this unit is reflected in the next set of figures. Figures 4-8 and 4-9 show the reconstituted effectiveness of the combat engineer company, before (Case 0) and after combat damage (Case 1, 2 and 3), as a function of drug abuse. Two horizontal scales are shown. The first indicates the percent of those personnel susceptible to drug abuse that are assumed to be abusing drugs. The lower scale indicates the equivalent percentage of the company's total population. Thus twenty percent of those susceptible to drugs equals thirteen of full authorization. The dotted horizontal line is the percent of effectiveness considering only materiel shortages. Where the dotted line is below the solid line, materiel is the limiting factor. This is the case at zero percent and ten percent drug abuse levels for all damage cases. It is not until higher levels of drug abuse are reached that personnel limitations govern unit effectiveness. The slope of the trend line for each damage case (considering only personnel) is an indication of the tolerance this unit has to drug abuse. These tolerance ratios (lost effectiveness: increase in drug abuse) are shown in Table 4-3. High numbers indicate a greater loss in effectiveness from drug abuse than do low numbers.

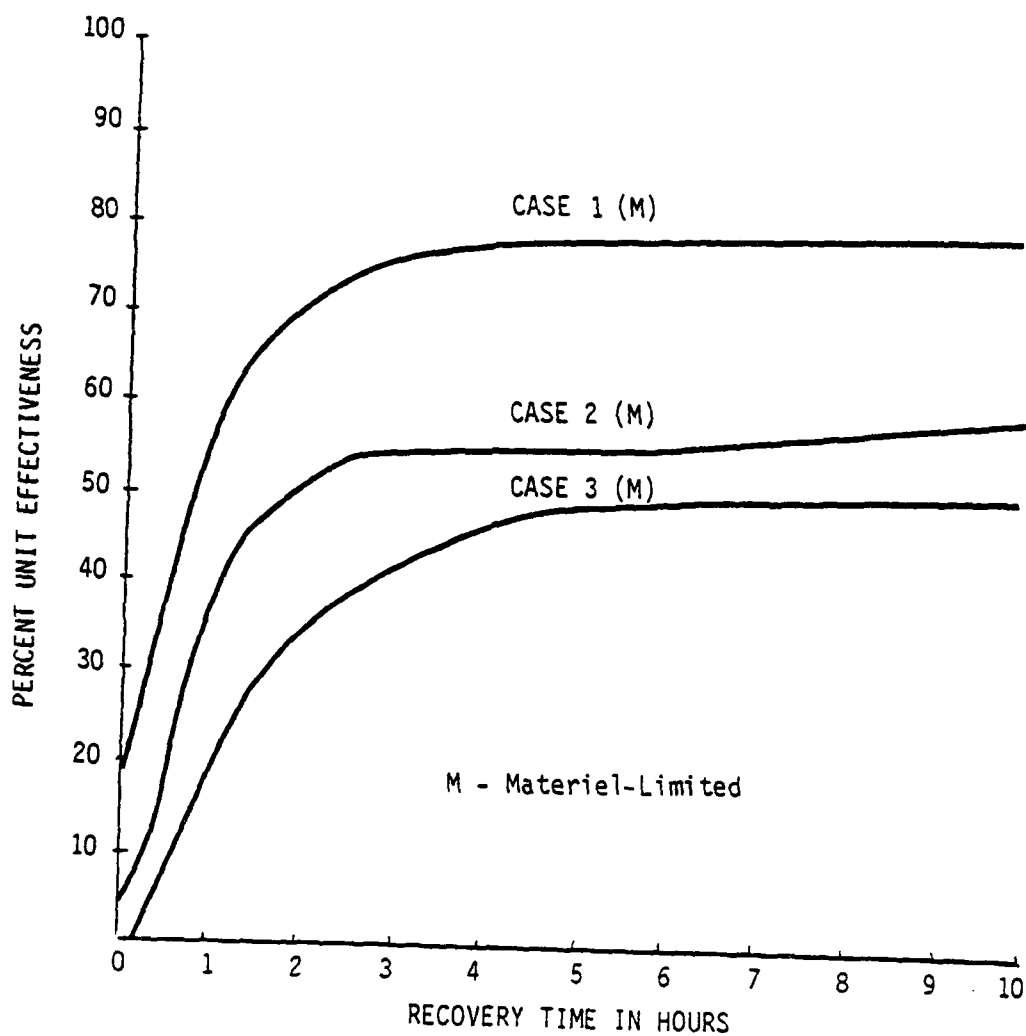


FIGURE 4-6. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, COMBAT ENGINEER COMPANY.

BASE CASE

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DAMAGE CASE		
TASK	NO	1	2	3
CONST EQ OP-5	8			X
CEV COMMANDER	6	X	X	
CONST SPEC-4	35			X
5 TON DRIVER	38			X
CONST EQ OP-3	14			X
CEV GUNNER	7	X	X	
PERS CARR DVR	44			X
SQUAD LDR	39			X
CO COMMANDER	1			
CEV DRIVER	11			
PLATOON LDR	33			
VEH DRIVER-4	36			
DEMO SPEC	41			
DEMO ASST	43			
CONST EQ OP-4	9			
CONST SPEC-4	42			
COMBAT CONST	45			

REQUIRED SUBSTITUTES		DAMAGE CASE		
TASK	NO	1	2	3
PER CARR DVR	4		X	X
GEN CONST OP	10	X	X	X
DUMP TRK DVR	12	X	X	X
PLATOON SGT	34			X
TOOL RM KEEPR	37	X	X	X
ASST SQD LDR	40	X	X	X

CRITICAL EQUIPMENT				
TYPE	NO	1	2	3
CEV	3	X	X	X
SCOOP LOADER	4	X	X	X
BULLDOZER	5	X	X	X
BACKHOE	6		X	X
CO TOOL KIT	7	X	X	X
5/4T-VRC 47	14		X	X
PLAT TOOL KIT	15	X	X	X
DEMO KIT	16	X	X	X
5 TON DUMP	18			X
APC GRC 160	19	X	X	X
DEMO KIT SQ	20	X	X	X
SQD TOOL KIT	21	X	X	X

FIGURE 4-7. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT FOR VARIOUS LEVELS OF COMBAT DAMAGE, COMBAT ENGINEER COMPANY

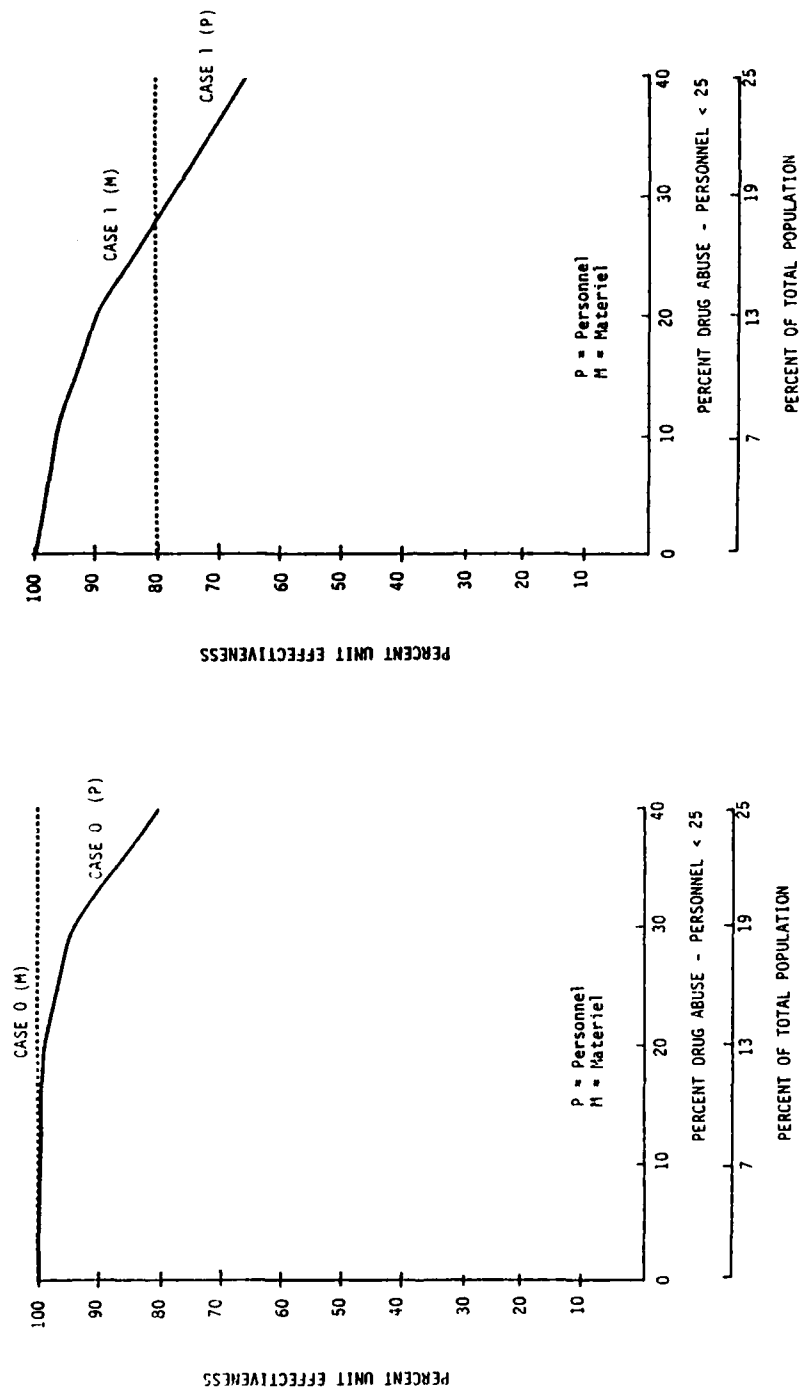


FIGURE 4-8. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 0 AND 1) AND VARIOUS LEVELS OF DRUG USE, COMBAT ENGINEER COMPANY.

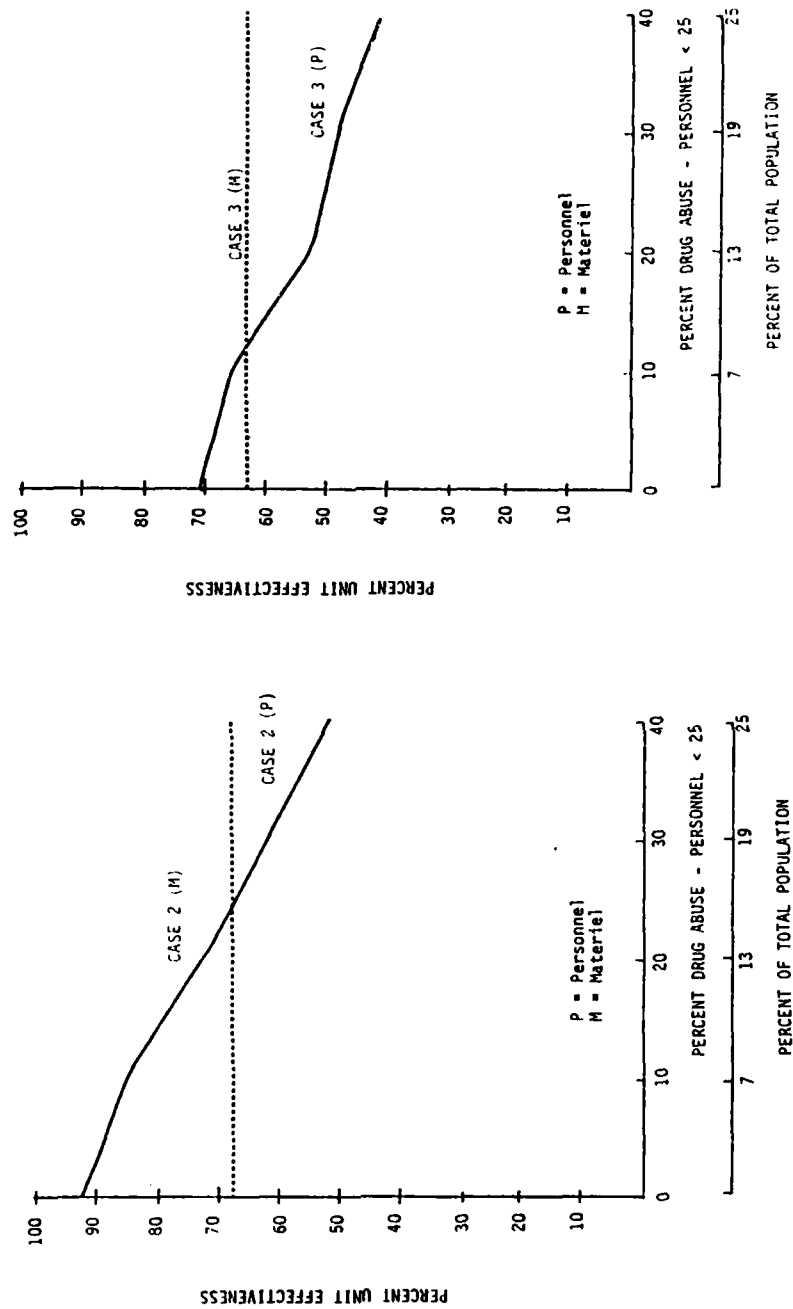


FIGURE 4-9. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 2 AND 3) AND VARIOUS LEVELS OF DRUG USE, COMBAT ENGINEER COMPANY.

TABLE 4-3. TOLERANCE RATIOS, COMBAT ENGINEER COMPANY

	DAMAGE CASE			
	0	1	2	3
RATIO	.46	.85	1.02	.79

The high of 1.02 at Damage Case 2 represents a condition where there is more than a one-for-one loss in effectiveness due to increase in drug abuse. Before suffering combat damage (Case 0), drug abuse has very little impact (.46) on unit effectiveness.

Figure 4-10 through 4-13 are similar to Figure 4-7 in that limiting functions (personnel and equipment) are shown. Critical personnel are now identified at each level of drug abuse for the four combat damage cases. The first column of each figure lists the same mission-essential personnel functions previously ranked from combat-damage sampling (Figure 4-7).

The impact on unit effectiveness of drug abuse when added to combat damage resulted in the identification of eight additional personnel functions as critical. They are shown below in Table 4-4, along with their probability of being filled by personnel less than twenty-five years of age.

DAMAGE CASE 0

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
CONST EQ OP-5	8			X	X	X
CEV COMMANDER	6					X
CONST SPEC-4	35					
5 TON DRIVER	38					
CONST EQ OP-3	14				X	X
CEV GUNNER	7					X
PERS CARR DVR	44					
SQUAD LDR	39					
CO COMMANDER	1					
CEV DRIVER	11					X
PLATOON LDR	33					
VEH DRIVER-4	36					
DEMO SPEC	41					
DEMO ASST	43					
CONST EQ OP-4	9				X	X
CONST SPEC-4	42					
COMBAT CONST	45					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO	0	1	2	3	4
GEN CONST OP	10			X	X	X
DUMP TRK DVR	12				X	
TOOL RM KEEPER	37				X	X
ASST SQD LDR	40					X

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
NONE						

FIGURE 4-10. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 0), COMBAT ENGINEER COMPANY.

DAMAGE CASE 1

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
CONST EQ OP-5	8		X	X	X	X
CEV COMMANDER	6		X	X	X	X
CONST SPEC-4	35				X	X
5 TON DRIVER	38				X	X
CONST EQ OP-3	14		X	X	X	X
CEV GUNNER	7			X	X	X
PERS CARR DVR	44				X	X
SQUAD LDR	39					
CO COMMANDER	1					
CEV DRIVER	11			X	X	X
PLATOON LDR	33					
VEH DRIVER-4	36					X
DEMO SPEC	41					
DEMO ASST	43					
CONST EQ OP-4	9				X	X
CONST SPEC-4	42				X	X
COMBAT CONST	45					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
PER CARR DVR	4					X
GEN CONST OP	10			X	X	X
DUMP TRK DVR	12			X	X	X
PLATOON SGT	34					X
TOOL RM KEEPR	37			X	X	X
ASST SOD LDR	40				X	X

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
CEV	3	X				
SCOOP LOADER	4	X				
BULLDOZER	5	X				
CO TOOL KIT	7	X				
PLAT TOOL KIT	15	X				
DEMO KIT	16	X				
APC CRC160	19	X				
DEMO KIT SQ	20	X				
SOD TOOL KIT	21	X				

FIGURE 4-11. MISSION LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), COMBAT ENGINEER COMPANY.

DAMAGE CASE 2

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
CONST EQ OP-5	8		X	X	X	X
CEV COMMANDER	6	X	X	X	X	X
CONST SPEC-4	35		X	X	X	X
5 TON DRIVER	38			X	X	X
CONST EQ OP-3	14		X	X	X	X
CEV GUNNER	7	X	X	X	X	X
PERS CARR DVR	44		X	X	X	X
SQUAD LDR	39				X	
CO COMMANDER	1			X	X	
CEV DRIVER	11		X		X	
PLATOON LDR	33					
VEH DRIVER-4	36		X	X	X	X
DEMO SPEC	41					
DEMO ASST	43		X	X	X	
CONST EQ OP-4	9		X			X
CONST SPEC-4	42			X	X	
COMBAT CONST	45					X

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO	0	1	2	3	4
PER CARR DVR	4		X	X	X	X
GEN CONST OP	10	X	X	X	X	X
DUMP TRK DVR	12			X	X	X
PLATOON SGT	34		X	X	X	X
TOOL RM KEEPR	37	X	X	X	X	X
ASST SQD LDR	40		X	X	X	X

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
CEV	3	X				
SCOOP LOADER	4	X				
BULLDOZER	5	X				
BACKHOE	6	X				
CO TOOL KIT	7	X				
5/4T-VRC 47	14	X				
PLAT TOOL KIT	15	X				
DEMO KIT	16	X				
APC GRC 160	19	X				
DEMO KIT SQ	20	X				
SQD TOOL KIT	21	X				

FIGURE 4-12. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 2), COMBAT ENGINEER COMPANY.

DAMAGE CASE 3

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO	0	1	2	3	4
CONST EQ OP-5	8	X	X	X	X	X
CEV COMMANDER	6	X	X	X	X	X
CONST SPEC-4	35	X	X	X	X	X
5 TON DRIVER	38	X	X	X	X	X
CONST EQ OP-3	14	X	X	X	X	X
CEV GUNNER	7	X	X	X	X	X
PERS CARR DVR	44	X	X	X	X	X
SQUAD LDR	39	X	X	X	X	X
CO COMMANDER	1			X	X	X
CEV DRIVER	11				X	X
PLATOON LDR	33					X
VEH DRIVER-4	36			X	X	X
DEMO SPEC	41		X	X		
DEMO ASST	43		X	X		X
CONST EQ OP-4	9			X	X	X
CONST SPEC-4	42		X	X	X	X
COMBAT CONST	45					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO	0	1	2	3	4
PER CARR DVR	4		X	X	X	X
GEN CONST OP	10	X	X	X	X	X
DUMP TRK DVR	12	X	X	X	X	X
PLATOON SGT	34	X	X	X	X	X
TOOL RM KEEPR	37	X	X	X	X	X
ASST SQD LDR	40	X	X	X	X	X

CRITICAL EQUIPMENT						
TYPE	NO	0	1	2	3	4
CEV	3	X				
SCOOP LOADER	4	X				
BULLDOZER	5	X				
BACKHOE	6	X				
CO TOOL KIT	7	X				
5/4T-VRC 47	14	X				
PLAT TOOL KIT	15	X				
DEMO KIT	16	X				
5 TON DUMP	18	X				
APC GRC 160	19	X				
DEMO KIT SQ	20	X				
SQD TOOL KIT	21	X				

FIGURE 4-13. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 3), COMBAT ENGINEER COMPANY.

TABLE 4-4. CRITICAL PERSONNEL FROM COMBAT DAMAGE
AND DRUG ABUSE, COMBAT ENGINEER COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
CONST EQ OP-5	62E2	.59
CEV COMMANDER	19E3	.03
CONST SPEC-4	12B1	.90
5 TON DRIVER	12B1	.90
CONST EQ OP-3	62E1	.88
CEV GUNNER	19E2	.12
PERS CARR DVR	12B1	.90
SQUAD LEADER	12B3	.06

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
CO COMMANDER	21A0	0
CEV DRIVER	19E1	.03
PLATOON LDR	21A0	.44
VEH DRIVER-4	12B1	.90
DEMO SPEC	12B2	.50
DEMO ASST	12B1	.90
CONST EQ OP-4	62E1	.88
CONST SPEC-4	12B1	.90
COMBAT CONST	12B1	.90

CHAPTER 5

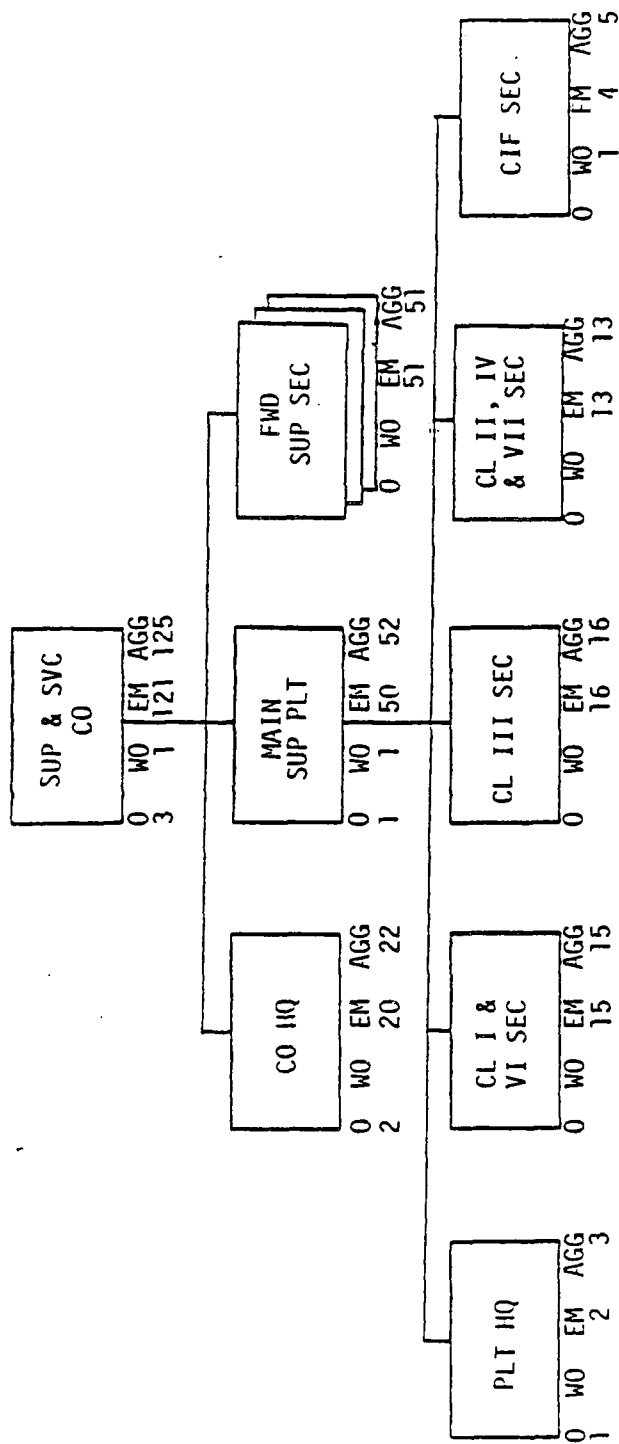
SUPPLY AND SERVICE COMPANY

The supply and service company is a unit in the supply and transport battalion, of the support command of the armored, infantry and mechanized infantry divisions. It provides most of the supplies required by the units of the division (other than ammunition) and is organized as shown in Figure 5-1. It provides supply support by establishing a main supply and distribution point for the division and 3 forward distribution points (one for each brigade). The main distribution point is operated by the main supply platoon of the company. This platoon provides Class I, II, III, IV, VI and VII support and operates a central issue facility. Each forward supply section operates a smaller version of the main distribution point; however, there is not normally a central issue capability at the forward distribution points. The company can provide bath facilities and graves-registration support when augmented with additional personnel and equipment. Augmentation is tailored to meet a particular situation and is not considered in this analysis.

The functional capability of the supply and service company is measured against its ability to establish and operate the main distribution point and three forward distribution points, providing support for all specified classes of supply to the brigades of a mechanized infantry division engaged in intensive combat for a short period of time.

Table 5-1 is a listing of the personnel functions identified by analysis of the TOE. All unique MOS's are considered and grouped into the thirty-four personnel tasks shown. The length of the bar to the right is a visual indication of the probability that MOS is occupied by an individual less than twenty-five years of age. The line number shown for each task is used as a reference for all tables and figures throughout this chapter.

Collateral damage to equipment, expected for the various assumed levels of personnel losses from combat, was determined by considering damage from conventional munitions and is shown in Table 5-2. The probability of damage to equipment is shown as light (operator repairable), moderate (unit repairable), and severe (cannot be repaired).



COMBAT MISSION

To support the division and attached units by providing Class I, II, III, IV, VI and VII supplies, except classified maps, aircraft and COMSEC equipment; provide and maintain the division reserve of supplies, and an emergency water point; classify and dispose of unserviceable equipment; and operate a division central issue facility.

ANALYSIS MISSION

To establish and maintain the division main distributing point and three forward distributing supply points to support the brigades of a Mechanized Infantry Division engaged in intense combat for a short period of time (24 hours).

FIGURE 5-1. SUPPLY AND SERVICE COMPANY, SUPPLY AND TRANSPORT BATTALION, ARMORED, INFANTRY OR MECHANIZED INFANTRY DIVISION, TOE 10-7110, CH 28.

TABLE 5-1. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, SUPPLY AND SERVICE COMPANY.

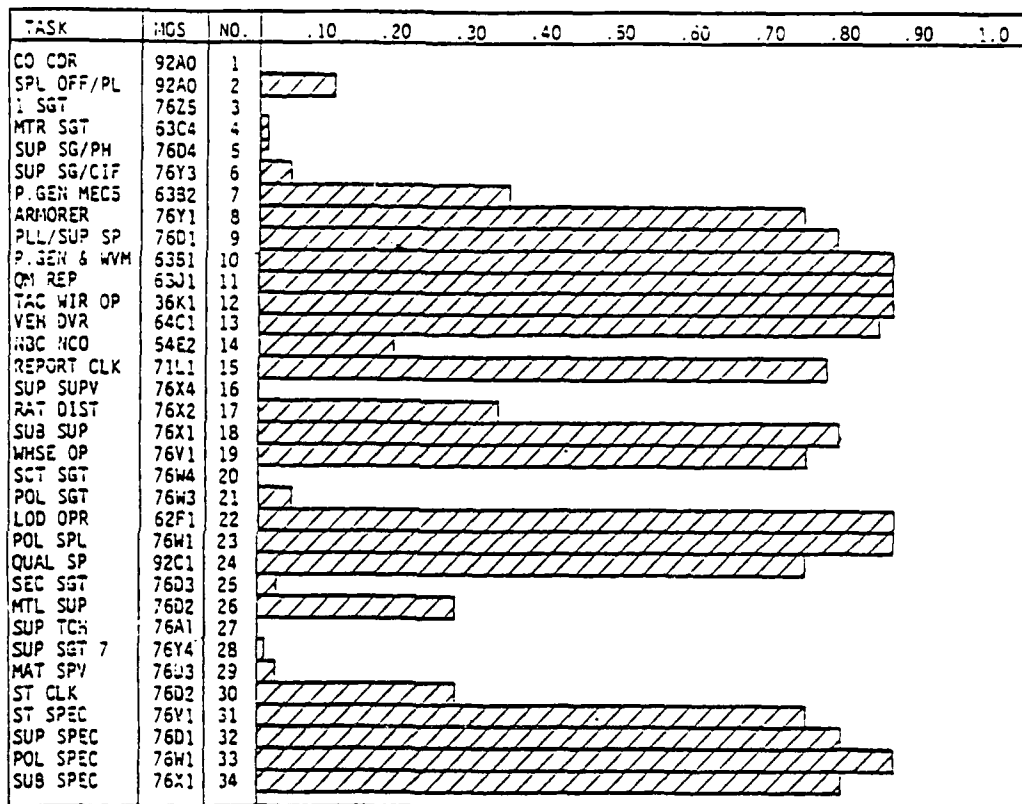


TABLE 5-2. EQUIPMENT DAMAGE PROBABILITIES

PERSONNEL CASUALTY LEVEL (%)	EQUIPMENT DAMAGE PROBABILITY		
	LIGHT	MODERATE	SEVERE
.10	.10	.03	.03
.20	.20	.05	.05
.30	.10	.06	.06

The decrease in the probability of light damage as personnel casualties increase from .20 to .30 is caused by more equipment being moderately and severely damaged as the number of volleys is increased to cause the desired .30 probability for personnel casualties.

SECTION II

TEAMS AND TRANSFER MATRICES

The company's personnel and equipment were formed into six teams, each providing an equal increment of operational capability plus necessary command and control elements as required. Each team adds personnel functions and equipment to the main supply platoon and forward sections. Team one has the bare essentials for part of the main platoon and sufficient assets to operate one forward distribution point at half its desired capacity. The second team increases the main platoon's capability by 1/6 and the single forward distribution point to one hundred percent effectiveness. Thus, a unit with two teams could operate part of the main distribution point and one forward distribution point; four teams would see a more efficient main distribution point and a capability to operate two forward distribution points on a twenty-four hour basis. Six teams represent one hundred percent unit effectiveness. The assignment of MOS functions to these teams is shown in Figure 5-2. The numbers are cumulative and indicate the total requirement for a given MOS in order for the unit to have the capability to build a given number of teams. To build three teams, for example, requires one power generator mechanic, 63B2 (7), and three power generator and wheeled vehicle mechanics, 63B1 (10), in addition to other functions. Some personnel functions are not essential to the mission under consideration but are capable of performing tasks which may be useful to the unit. For example, the ration-distribution sergeant, 76 X 2, (number 17) is considered unnecessary for this mission but he can perform the duties of the supply supervisor (16) or subsistence supply specialist (18) if they are absent. These and other allowable transfers are shown in Figure 5-3. Personnel functions are listed by task vertically and horizontally. The entries in the matrix reflect the time, in minutes, required for a task (column) to assume a function (row). From the example above, number 17 (left vertical column) is the ration-distribution sergeant. Following row 17 to column 16 an entry of 25 indicates twenty-five minutes are required for 17 to assume the function of 16. Zeros on the diagonal reflect the assumption that personnel are qualified to perform their own functions. No entry indicates a transfer is not allowed.

Figure 5-4 shows the cumulative team assignments for equipment and matches the personnel requirements listed in the matrix at Figure 5-2. The VRC-46 radio (15) is required at each forward

TASK	NO	TOE	1	2	3	4	5	6
CO CDR	1	1	1	1	1	1	1	1
SPL OFF/PL	2	2				1	1	1
FIRST SGT	3	1						
MTR SGT	4	1						
SUP SG/PH	5	2		1	1	1	2	2
SUP SG/CIF	6	2	1	1	1	2	2	2
P GEN MEC 5	7	2			1	1	1	1
ARMORER	8	2	1	1	1	1	1	1
PLL/SUP SP	9	7	2	3	4	5	6	7
P GEN & WVM	10	6	1	2	3	4	5	6
QM REP	11	3						
TAC WIR OP	12	1						
V_H DVR	13	2			1	1	1	1
NBC NCO	14	1						
REPORT CLK	15	2						
SUP SUPV	16	1	1	1	1	1	1	1
RAT DIST	17	1						
SUB SUP	18	12	2	4	6	8	10	12
WHSE OP	19	4	1	2	2	2	3	4
SCT SGT	20	1	1	1	1	1	1	1
POL SGT	21	1						
LOD OPR	22	1	1	1	1	1	1	1
POL SPL	23	10	1	3	5	7	9	10
QUAL SP	24	1						1
SEC SGT	25	1	1	1	1	1	1	1
MTL SUP	26	4		1	2	2	3	4
SUP TECH	27	1	1	1	1	1	1	1
SUP SGT 7	28	1						
MAT SPV	29	3	1	1	2	2	3	3
ST CLK	30	3		1	1	2	2	3
ST SPEC	31	18	3	6	9	12	15	18
SUP SPEC	32	6	1	2	3	4	5	6
POL SPEC	33	9	1	3	4	6	7	8
SUB SPEC	34	12	2	4	6	8	10	12

FIGURE 5-2. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, SUPPLY AND SERVICE COMPANY

TRANSFER MATRIX FOR PERSONNEL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1	0	0																																
2	30	0	30																															
3		30	0																	30														
4			0	30																														
5			45		0	30																												
6				30	0																													
7						0																												
8						0	0																											
9							0	0																										
10							45																											
11								0																										
12									0																									
13										0																								
14											0																							
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29																										0								
30																											0							
31																												0						
32																													0					
33																														0				
34																															0			

FIGURE 5-3. TRANSFER MATRIX, PERSONNEL, SUPPLY AND SERVICE COMPANY

support location so an additional radio is shown at team 1, 3 and 5. Substitutability among equipment is shown in Figure 5-5 and is read in the same manner as the personnel transfer matrix, except the reference number reflects the equipment item. Times shown in Figure 5-5 reflect the time for the equipment to be moved from one location to another plus any time that might be required to transfer equipment.

The teams, matrices, and damage probabilities described above are used in the AMORE methodology as input. The shortages of essential personnel and equipment are assessed and the model reassigns available personnel and equipment to reconstitute the maximum number of teams in the shortest possible time.

EQUIPMENT	NO	TOE	1	2	3	4	5	6
GENERATORS	1	4			1	2	3	4
1/4 T-VRC-46	2	3	1	1	2	2	3	3
AUTO SH/TK	3	10	2	4	6	8	9	10
5/4 T	4	3		1	1	2	2	3
5/4 T HQ	5	6	1	2	3	4	5	6
5 T WRECKER	6	1					1	1
FORK LIFT	7	3	1	1	2	2	3	3
RAMP LOAD	8	5		1	2	3	4	5
500 G DR H	9	18	3	6	9	12	15	18
FARE HQ	10	2		1	1	1	2	2
60000 TANK	11	1				1	1	1
10000 TANK	12	6	1	2	3	4	5	6
500 G DR F	13	9	1	3	4	6	7	9
FARE FSS	14	3	1	1	2	2	3	3
5/4 T-VRC-46	15	3	1	1	2	2	3	3
5/2 T FSS	16	3		1	1	2	2	3

Figure 5-4. Cumulative Team Requirements, Materiel, Supply and Service Company.

TRANSFER MATRIX FOR MATERIAL.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	0	.	.	.	.	.	.	.	.	.	.	.	.	60	.
3	.	.	0	.	.	.	.	.	.	.	.	.	.	.	.	.
4	.	45	.	0	.	.	.	.	.	.	.	.	.	.	60	.
5	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	60
6	0	.	.	.	.	.	.	.	.	.	.
7	0	.	.	.	.	.	.	.	.	.
8	0	.	.	.	.	.	.	.	.
9	0	.	.	.	60	.	.	.
10	0	.	.	.	60	.	.
11	0	.	.	.	.	.
12	0	.	.	.	.
13	60	.	.	.	0	.	.	.
14	60	.	.	.	0	.	.
15	.	60	.	60	.	.	.	.	.	.	.	.	.	.	0	.
16	.	.	.	30	60	.	.	.	.	.	.	.	.	.	.	0

FIGURE 5-5. TRANSFER MATRIX, MATERIEL, SUPPLY AND SERVICE COMPANY.

SECTION III

RESULTS

Figure 5-6 is a display of the effectiveness of the supply and service company as a function of time for three levels of assumed combat damage. In all three cases the unit was able to maximize its effectiveness after about three hours. The unit is sensitive to damage and loses a larger percentage of capability for a like increase in damage. Personnel casualties of ten percent and severe materiel damage of three percent (Case 1) reduce the unit's effectiveness to less than eighty percent. Note that it is the three percent damage to materiel (M) that limits unit effectiveness and not the ten percent personnel losses. Personnel casualties play an increasingly important role and dominate the units ability to reconstitute teams when personnel losses reach thirty percent with an associated materiel damage of six percent (Case 3). Unit effectiveness is reduced to approximately fifty percent for Case 3.

Personnel functions and equipment that limit the forward support company's ability to perform are listed in Figure 5-7. Personnel tasks essential to mission accomplishment are listed in the first column, ranked by criticality based on a detailed analysis of the unit's ability to recover its effectiveness after three levels of combat damages. An "X" indicates the damage level at which a particular function restricted the unit's ability to achieve a higher level of effectiveness.

The POL specialist, (33) power generator and wheeled vehicle mechanic (10), and several other personnel functions were critical at all damage levels. In the upper right of Figure 5-7 are listed those personnel functions, not in themselves essential, that were required for substitution of some of the critical personnel. Critical equipment is listed in the bottom right of the figure.

Figures 5-8, and 5-9 show the effectiveness of the supply and service company following combat damage (4 cases) as a function of varying levels of drug abuse. Two horizontal scales are shown. The upper scale is the percent of drug users among those susceptible to drug abuse (less than twenty-five years old). The lower scale is that equivalent percentage of the entire unit population. Thus, ten percent of those less than twenty-five years old equates to six percent of the unit's authorized strength.

SUPPLY AND SERVICE COMPANY

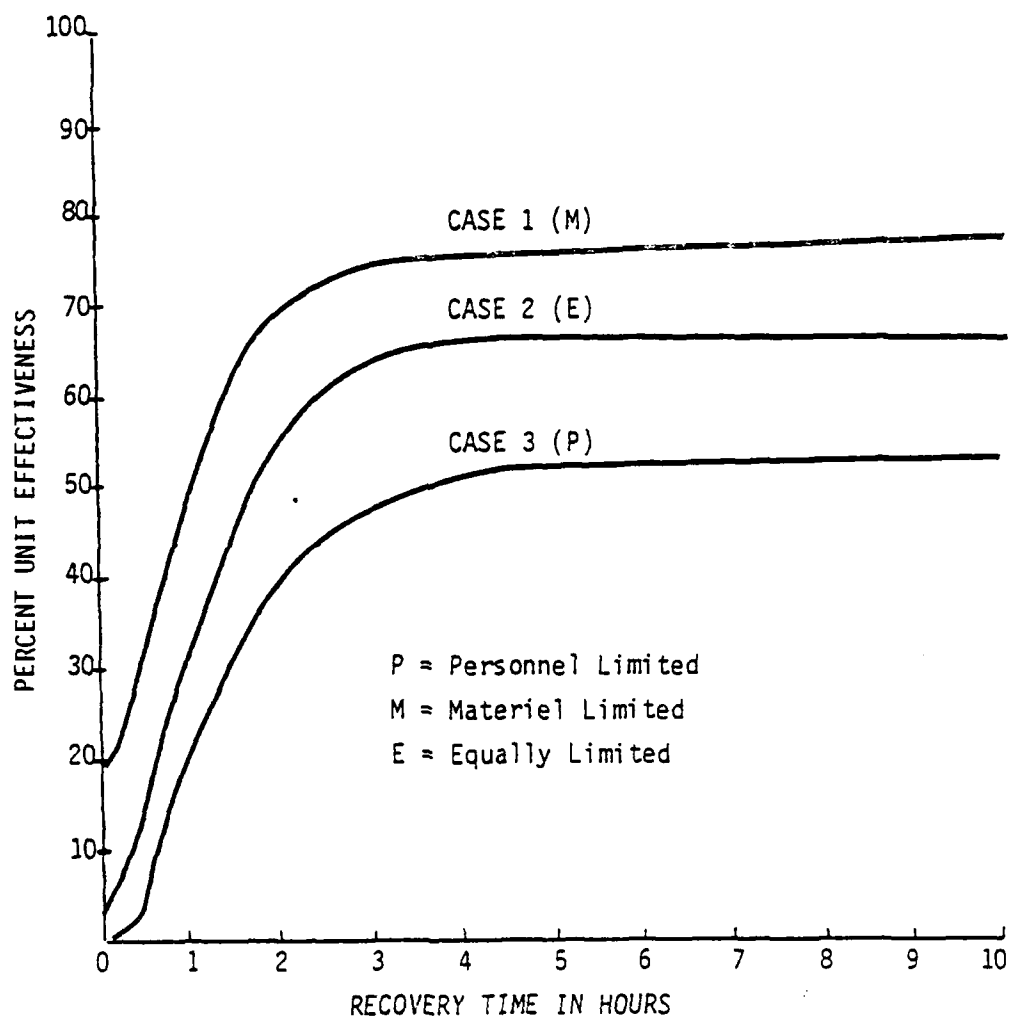


FIGURE 5-6. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, SUPPLY AND SERVICE COMPANY.

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DAMAGE CASE		
TASK	NO.	1	2	3
POL SPEC	33	X	X	X
SUB SPEC	34	X	X	X
P.GEN & WVM	10	X	X	X
ST SPEC	31	X	X	X
SEC SGT	25		X	X
MAT SPV	29	X	X	X
WHSE OP	19	X	X	X
SUP SPEC	32	X	X	X
POL SPL	23	X	X	X
MTL SUP	26	X	X	X
CO CDR	1			X
SCT SGT	20		X	X
SUB SUP	18	X	X	X
ST CLK	30	X	X	
QUAL SP	24		X	
PLL/SUP SP	9		X	X
SUP SG/PH	5		X	X
SUP SG/CIF	6			X
SUP SUPV	16			
LOD OPR	22			
SUP TCH	27			
ARMORER	8			
P.GEN MEC/5	7			
VEH DVR	13			
SPL OFF/PL	2			

REQUIRED SUBSTITUTES		DAMAGE CASE		
TASK	NO.	1	2	3
1 SGT	3	X	X	X
MTR SGT	4	X	X	X
NBC NCO	14	X	X	X
RAT DIST	17	X	X	X
POL SGT	21	X	X	X
SUP SGT	28	X	X	X

CRITICAL EQUIPMENT				
TYPE	NO.	1	2	3
GENERATOR	1	X	X	X
1/4T-VRC46	2	X	X	X
AUTO SH/TK	3	X	X	X
5/4T	4	X	X	X
5/2T HQ	5	X	X	X
5T WRECKER	6	X	X	X
FORK LIFT	7	X	X	X
RAMP LOAD	8	X	X	X
500 G DR H	9	X	X	X
FARE HQ	10	X	X	X
60000 TANK	11		X	X
10000 TANK	12	X	X	X
500 G DR F	13	X	X	X
FARE FSS	14	X	X	X
5/4T-VRC26	15	X	X	X
5/2T FSS	16	X	X	X

FIGURE 5-7. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT FOR VARIOUS LEVELS OF COMBAT DAMAGE, SUPPLY AND SERVICE COMPANY.

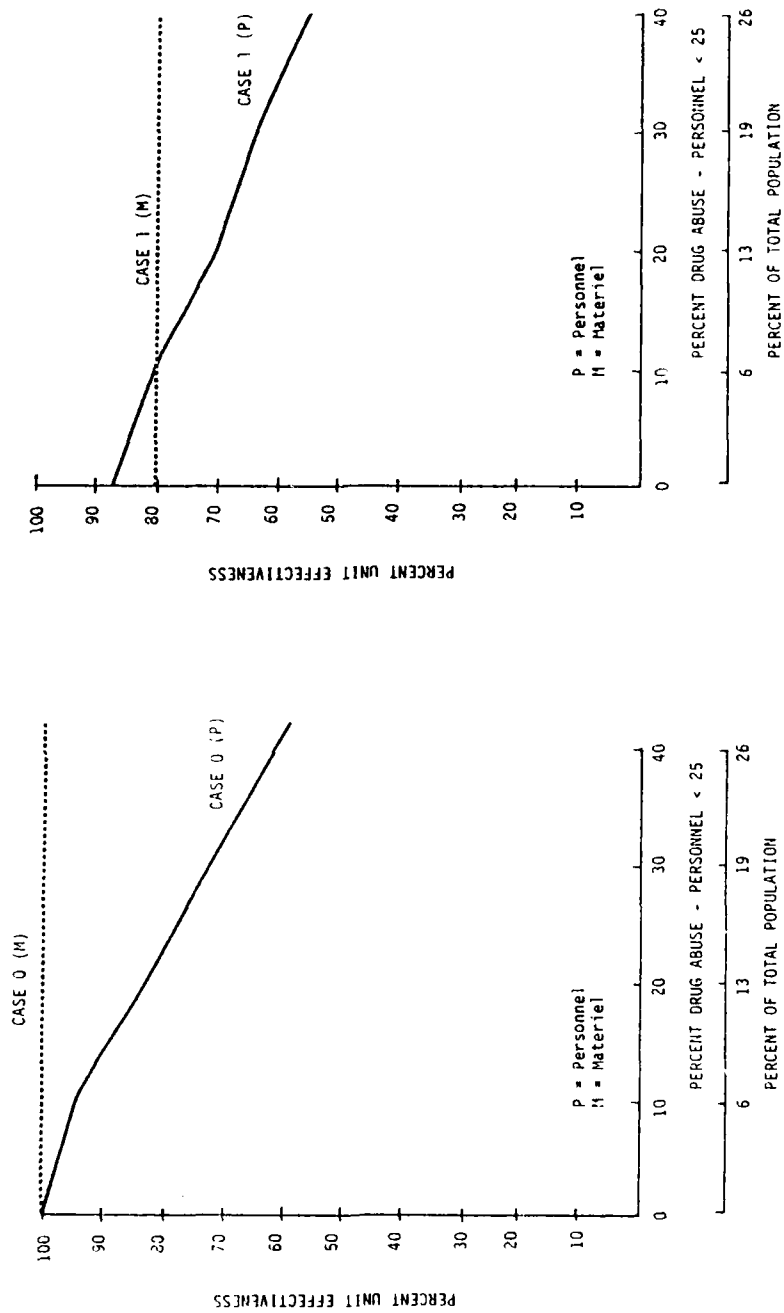


FIGURE 5-8. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 0 AND 1) AND VARIOUS LEVELS OF DRUG USE, SUPPLY AND SERVICE COMPANY.

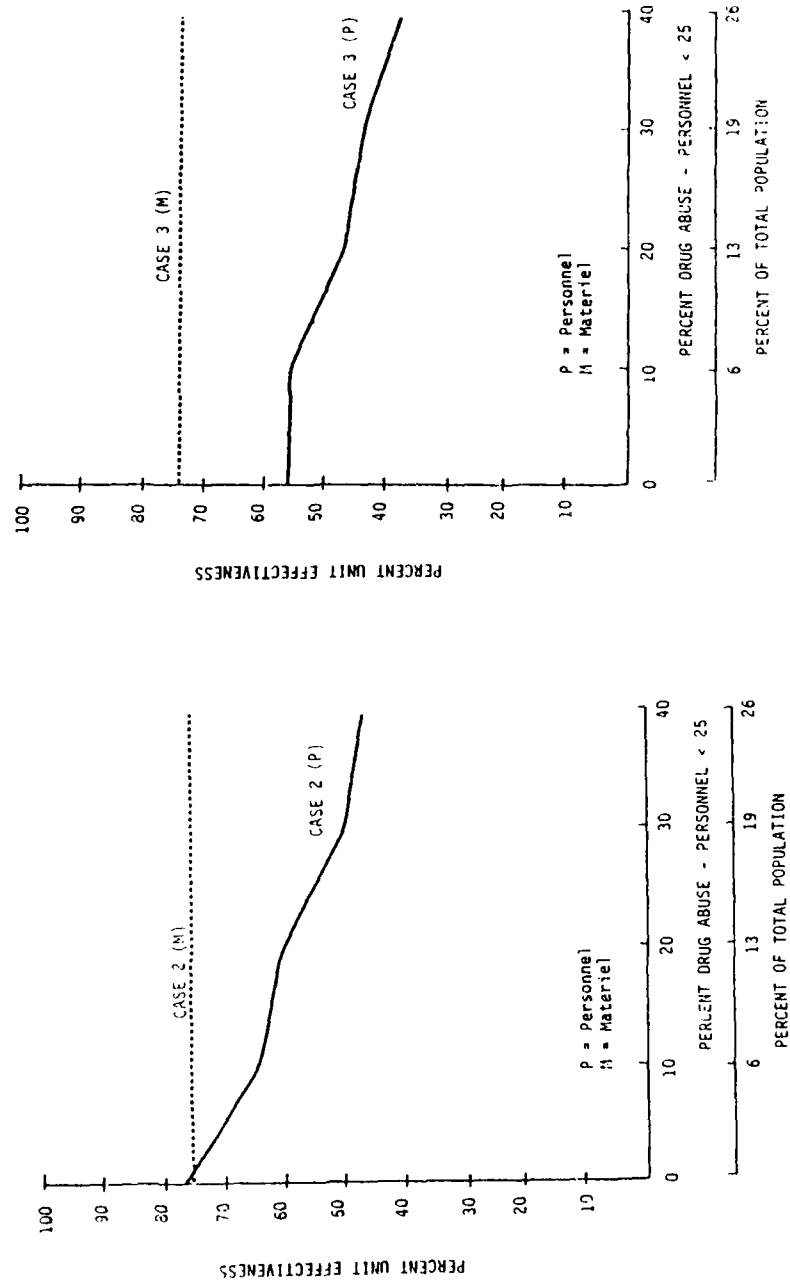
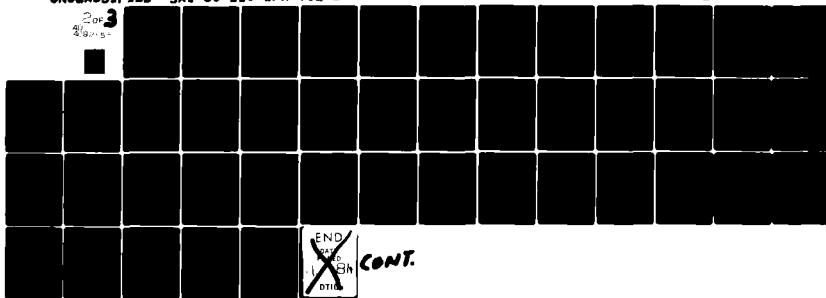


FIGURE 5-9. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 2 AND 3) AND VARIOUS LEVELS OF DRUG USE, SUPPLY AND SERVICE COMPANY.

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SCIENCE APPLICATIONS INC MCLEAN VA F/G 12/2
AN ASSESSMENT OF THE HYPOTHETICAL IMPACT OF DRUG ABUSE ON COMBA--ETC(U)
APR 80 B TULLINGTON, H STRICKLAND, D GAEBEL DAMD17-79-C-9107
UNCLASSIFIED SAI-80-113-W/A-VOL-2 NL

2 of 3
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The dotted line indicates the limiting effects of materiel shortages at the various combat-damage levels. There is little change in impact on effectiveness from materiel damage at cases 1, 2, or 3. Most effectiveness is lost with the initial three percent damage to equipment.

The addition of drug abuse seriously reduces unit capability before any combat damage (Case 0). Drug abuse has less effect when personnel losses from combat reach thirty percent. Table 3-3 shows the tolerance ratios for the supply and service company at each combat damage case. The high of .94 at Damage Case 0 represents almost a one-for-one loss of effectiveness to increased drug abuse. The smaller ratio of .62 at Case 3 reflects the reduced impact of drug abuse on the unit at this level of combat damage.

TABLE 5-3. TOLERANCE RATIOS, SUPPLY AND SERVICE COMPANY

	DAMAGE CASE			
	0	1	2	3
RATIO	.94	.88	.87	.62

Figures 5-10 through 5-13 show limiting functions in a format similar to Figure 5-7, but the critical personnel are now identified at each level of drug abuse for each of the four damage cases.

The first column lists the same mission-essential personnel functions ranked previously from combat-damage sampling (Figure 5-7). The impact on unit effectiveness of adding drug abuse to combat damage resulted in the identification of additional personnel functions to the list of those previously identified as critical. They are shown below in Table 3-4 along with their probability of being less than twenty-five years of age.

DAMAGE CASE 0

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
POL SPEC	33		X	X	X	X
SUB SPEC	34		X	X	X	X
P.GEN & WVM	10		X	X	X	X
ST SPEC	31		X	X	X	X
SEC SGT	25					
MAT SPV	29					
WHSE OP	19			X	X	X
SUP SPEC	32			X	X	X
POL SPL	23		X	X	X	X
MTL SUP	26			X	X	X
CO CDR	1					
SCT SGT	20					
SUB SUP	18			X	X	X
ST CLK	30					
QUAL SP	24			X	X	X
PLL/SUP SP	9			X	X	X
SUP SB/PH	5					
SUP SB/CIF	6					
SUP SUPV	16					
LOD OPR	22					
SUP TCH	27					
ARMORER	8					
P.GEN MEC/5	7					
VEH DVR	13					
SPL OFF/PL	2					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
1 SGT	3		X	X	X	X
MTR SGT	4		X			
NBC NCO	14		X	X	X	X
REPORT CLK	15		X	X	X	X
RAT DIST	17		X	X	X	X
POL SGT	21		X	X	X	X
SUP SGT 7	28		X	X	X	X

CRITICAL EQUIPMENT						
TYPE	NO.	0	.1	.2	.3	.4
GENERATOR	1					
1/4T-VRC46	2					
AUTO SH/TK	3					
5/4T	4					
5/2T HQ	5					
5T WRECKER	6					
FORK LIFT	7					
RAMP LOAD	8					
500 G DR H	9					
FARE HQ	10					
60000 TANK	11					
10000 TANK	12					
500 G DR F	13					
FARE FSS	14					
5/4T-VRC46	15					
5/2T FSS	16					

FIGURE 5-10. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 0), SUPPLY AND SERVICE COMPANY.

DAMAGE CASE 1

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
POL SPEC	33	X	X	X	X	X
SUB SPEC	34	X	X	X	X	X
P.GEN & WVM	10	X	X	X	X	X
ST SPEC	31	X	X	X	X	X
SEC SGT	25			X		
MAT SPV	29	X			X	
WHSE OP	19	X	X	X	X	X
SUP SPEC	32	X	X	X	X	X
POL SPL	23	X	X	X	X	X
MTL SUP	26	X	X	X	X	
CO CDR	1					
SCT SGT	20					
SUB SUP	18	X	X	X	X	X
ST CLK	30	X	X	X	X	
QUAL SP	24		X	X	X	
PLL/SUP SP	9		X	X	X	X
SUP SB/PH	5					
SUP SG/CIF	6				X	
SUP SUPV	16					
LOD OPR	22				X	X
SUP TCH	27					
ARMORER	8					
P.GEN MEC/5	7				X	X
VEH DVR	13					
SPL OFF/PL	2					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
1 SGT	3	X	X	X	X	X
MTR SGT	4	X	X	X	X	X
NBC NCO	14	X	X	X	X	X
REPORT CLK	15	X	X	X	X	X
RAT DIST	17	X	X	X	X	X
POL SGT	21	X	X	X	X	X
SUP SGT 7	28	X	X	X	X	X

CRITICAL EQUIPMENT						
TYPE	NO.	0	.1	.2	.3	.4
GENERATOR	1	X				
1/4T-VRC46	2	X				
AUTO SH/TK	3	X				
5/4T	4	X				
5/2T HQ	5	X				
5T WRECKER	6	X				
FORK LIFT	7	X				
RAMP LOAD	8	X				
500 G DR H	9	X				
FARE HQ	10	X				
60000 TANK	11					
10000 TANK	12	X				
500 G DR F	13	X				
FARE FSS	14	X				
5/4T-VRC46	15	X				
5/2T FSS	16	X				

FIGURE 5-11. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), SUPPLY AND SERVICE COMPANY.

DAMAGE CASE 2

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL					
TASK	NO.	0	.1	.2	.3	.4	
POL SPEC	33	X	X	X	X	X	
SUB SPEC	34	X	X	X	X	X	
P.GEN & WVM	10	X	X	X	X	X	
ST SPEC	31	X	X	X	X	X	
SEC SGT	25	X	X		X	X	
MAT SPV	29	X	X	X	X		
WHSE OP	19	X	X	X	X		
SUP SPEC	32	X	X	X	X	X	
POL SPL	23	X	X	X	X	X	
MTL SUP	26	X	X	X	X		
CO COR	1		X	X	X	X	
SCT SGT	20	X	X	X	X		
SUB SUP	18	X	X	X	X	X	
ST CLK	30	X	X				
QUAL SP	24	X					
PLL/SUP SP	9	X	X	X	X	X	
SUP SG/PH	5	X		X			
SUP SG/CIF	6						
SUP SUPV	16						
LOD OPR	22			X	X	X	
SUP TCH	27					X	
ARMORER	8						
P.GEN MEC/5	7		X	X	X		
VEH DVR	13						
SPL OFF/PL	2						

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS					
TASK	NO.	0	.1	.2	.3	.4	
1 SGT	3	X	X	X	X	X	
MTR SGT	4	X	X	X	X	X	
NBC NCO	14	X	X	X	X	X	
REPORT CLK	15	X	X	X	X	X	
RAT DIST	17	X	X	X	X	X	
POL SGT	21	X	X	X	X	X	
SUP SGT 7	28	X	X	X	X	X	

CRITICAL EQUIPMENT						
TYPE	NO.	0	.1	.2	.3	.4
GENERATOR	1	X				
1/4T-VRC46	2	X				
AUTO SH/TK	3	X				
5/4T	4	X				
5/2T HQ	5	X				
5T WRECKER	6	X				
FORK LIFT	7	X				
RAMP LOAD	8	X				
500 G DR H	9	X				
FARE HQ	10	X				
60000 TANK	11	X				
10000 TANK	12	X				
500 G DR F	13	X				
FARE FSS	14	X				
5/4T-VRC46	15	X				
5/2T FSS	16	X				

FIGURE 5-12. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 27), SUPPLY AND SERVICE COMPANY.

DAMAGE CASE 3

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL					
TASK	NO.	0	.1	.2	.3	.4	
POL SPEC	33	X	X	X	X	X	
SUB SPEC	34	X	X	X	X	X	
P.GEN & WVM	10	X	X	X	X	X	
ST SPEC	31	X	X	X	X	X	
SEC SGT	25	X	X	X	X	X	
MAT SPV	29	X	X	X	X	X	
WHSE OP	19	X	X	X	X	X	
SUP SPEC	32	X	X	X	X	X	
POL SPL	23	X	X	X	X	X	
MTL SUP	26	X	X	X	X	X	
CO CDR	1	X	X	X	X	X	
SCT SGT	20	X	X	X	X	X	
SUB SUP	18	X	X	X	X	X	
ST CLK	30	X	X	X	X	X	
QUAL SP	24	X	X	X	X	X	
PLL/SUP SP	9	X	X	X	X	X	
SUP SG/PH	5	X	X	X	X	X	
SUP SB/CIF	6	X	X	X	X	X	
SUP SUPV	16	X	X	X	X	X	
LOD OPR	22	X	X	X	X	X	
SUP TCH	27	X	X	X	X	X	
ARMORER	8	X	X	X	X	X	
P.GEN MEC/5	7	X	X	X	X	X	
VEH DVR	13	X	X	X	X	X	
SPL OFF/PL	2	X	X	X	X	X	

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS					
TASK	NO.	0	.1	.2	.3	.4	
1 SGT	3	X	X	X	X	X	
MTR SGT	4	X	X	X	X	X	
NBC NCO	14	X	X	X	X	X	
REPORT CLK	15	X	X	X	X	X	
RAT DIST	17	X	X	X	X	X	
POL SGT	21	X	X	X	X	X	
SUP SGT 7	28	X	X	X	X	X	

CRITICAL EQUIPMENT						
TYPE	NO.	0	.1	.2	.3	.4
GENERATOR	1	X				
1/4T-VRC46	2	X				
AUTO SH/TK	3	X				
5/4T	4	X				
5/2T HQ	5	X				
5T WRECKER	6	X				
FORK LIFT	7	X				
RAMP LOAD	8	X				
500 G DR H	9	X				
FARE HQ	10	X				
60000 TANK	11	X				
10000 TANK	12	X				
500 G DR F	13	X				
FARE FSS	14	X				
5/4T-VRC46	15	X				
5/2T FSS	16	X				

FIGURE 5-13. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 3), SUPPLY AND SERVICE COMPANY.

TABLE 5-4. CRITICAL PERSONNEL FROM COMBAT DAMAGE
AND DRUG ABUSE, SUPPLY AND SERVICE COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
POL SPEC	76W1	.86
SUB SPEC	76Y1	.78
PGEN & WVM	63B1	.87
ST SPEC	76V1	.73
SFC SGT	76D3	.02
MAT SPV	76D3	.02
WHSE OP	76V1	.73
SUP SPEC	76D1	.79
POL SPL	76W1	.86
MTL SUP	76D2	.26
CO CDR	92A0	0
SCT SGT	76W4	0
SUBSUP	76X1	.18
ST CLK	76D2	.26
QUAL SP	92C1	.76
PLL/SUPSP	76D1	.79
SUP SG/PH	76D4	.01
SUP SG/AF	76Y3	.05

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
SUP SUPV	76X4	0
LOD OPR	62F1	.86
SUP TCH	76A1	0
ARMORER	76Y1	.76
PGEN MECH-5	63B2	.35

CHAPTER 6

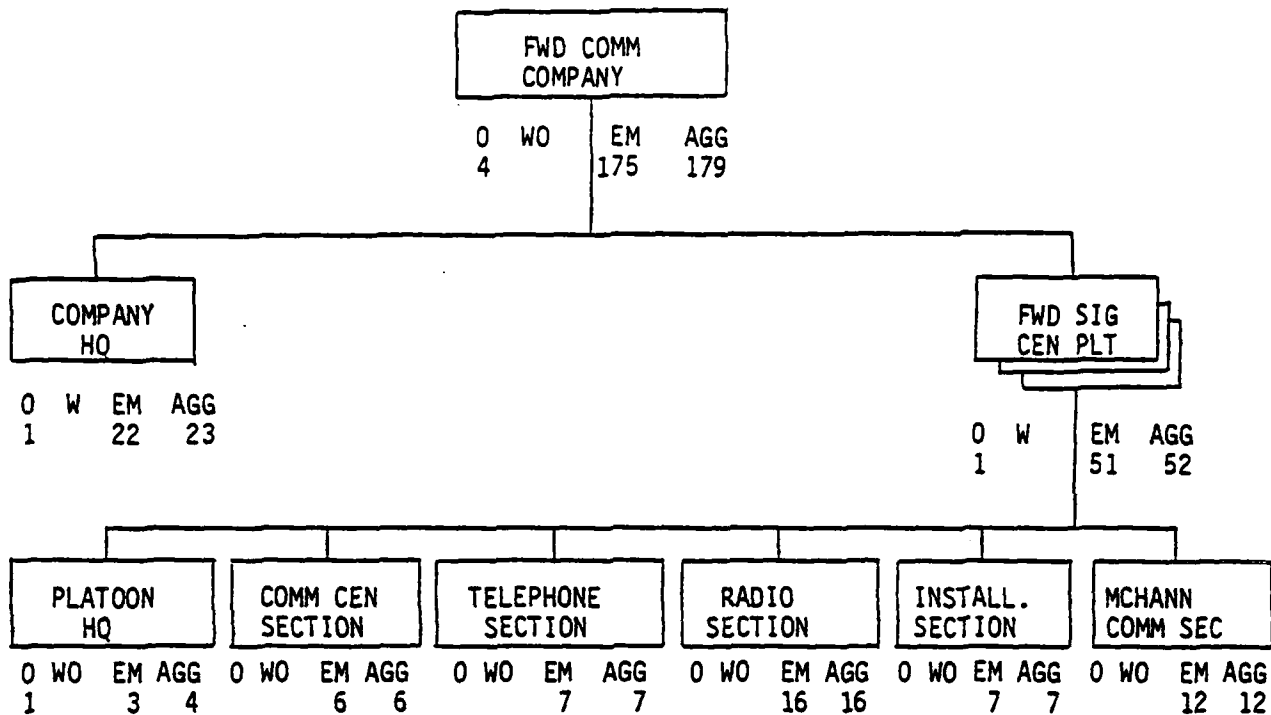
FORWARD COMMUNICATIONS COMPANY

The forward communications company of the division signal battalion provides area signal centers in the forward areas of the division zone of operation. The company is unique to the signal battalion and is organized as shown in Figure 6-1. The company is capable of establishing three area signal centers, each providing secure teletypewriter terminal facilities, switchboard service, radio-wire-integration, FM radio, and retransmission facilities.

The measure of effectiveness used to evaluate the forward communications company's ability to perform its mission-essential functions is the degree to which the company could establish three complete area signal centers to operate on a twenty-four-hour-a-day basis. It is assumed that each forward signal center is supporting a brigade engaged in armor-heavy combat.

Table 6-1 is a listing of the personnel functions identified from analysis of the unit TOE. All unique MOS's are considered and grouped into the thirty-five personnel tasks shown. The length of the bar to the right is a visual indication of the probability that that MOS is occupied by someone less than twenty-five years of age. The line numbers shown for each task are used as a reference for all tables and figures in this chapter.

Collateral damage to equipment expected for the various assumed levels of personnel losses from combat was determined by considering damage from conventional munitions and is shown in Table 6-2. The probability of damage to equipment is shown as light (operator repairable), moderate (unit repairable) and severe (cannot be repaired).



COMBAT MISSION

To provide area signal centers in the forward areas of the division zone of operations

ANALYSIS MISSION

To establish and maintain forward area signal centers to provide communications between a division headquarters and its armor, infantry or mechanized brigades involved in intense combat for a short period of time (24 hours)

FIGURE 6-1. FORWARD COMMUNICATIONS COMPANY, SIGNAL BATTALION ARMORED, INFANTRY OR MECHANIZED DIVISION. TOE-11-38H0, CH17.

TABLE 6-1. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, FORWARD COMMUNICATIONS COMPANY.

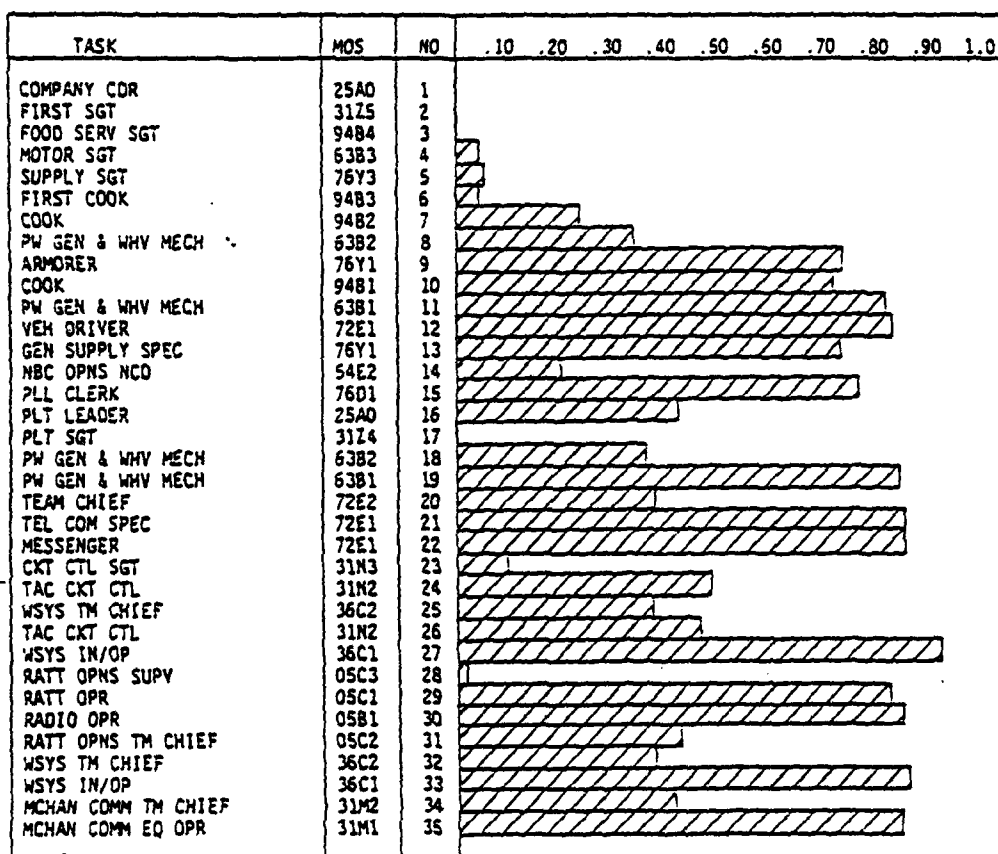


TABLE 6-2. EQUIPMENT DAMAGE PROBABILITIES

PERSONNEL CASUALTY LEVEL	EQUIPMENT DAMAGE PROBABILITY		
	LIGHT	MODERATE	SEVERE
.10	.10	.03	.03
.20	.20	.05	.05
.30	.10	.06	.06

The decrease in the probability of light damage as personnel casualties increase from .20 to .30 is caused by more equipment being moderately and severely damaged as the number of volleys is increased to cause the desired .30 probability for personnel casualties.

SECTION II

TEAMS AND TRANSFER MATRICES

The company's personnel and equipment were formed into twelve teams, each providing an equal increment in communications capability plus necessary command and control elements as required. Each team adds only those personnel functions and items of equipment that increase that platoon's ability to communicate. Early teams require FM radio facility and operators, while the more sophisticated secure and wire-communication capability is added to the later teams. Six teams provide sufficient assets to operate three forward signal centers at half the desired capacity. The remaining six teams increase that capability to one hundred percent. The assignment of MOS functions to these teams is shown in Figure 6-2. The numbers are cumulative and indicate the total required for a given MOS in order for the unit to have the capability to build a given number of teams. To build three teams, for example, requires one power generator mechanic 63B2 (8) two platoon leaders, 25A0 (16), and three messengers, 72E1 (22), in addition to the other functions indicated. Some personnel functions do not require the total number authorized in order to satisfy mission requirements. These extra personnel are available to perform other tasks which may be required by the unit. For example, only six of nine telecom center specialists (21) are required. This leaves three available for duty elsewhere.

Figure 6-3, shows substitutability among the MOS's in the company. Personnel functions are listed by task vertically and horizontally. The entries in the matrix reflect the time, in minutes, required for a task (row) to assume a function (column). For example, number 21 (left vertical column) can assume the role of team chief (20) in fifteen minutes. This is found in the matrix by first locating 21 in the left column and then following row 17 to the right to column 20. A 15 in column 20 indicates fifteen minutes are required for 21 to assume the function of 20. Zeros on the diagonal reflect the assumption that personnel are qualified to perform their own function with no penalty in time. No entry indicates a transfer is not allowed.

Figure 6-4 shows the cumulative team assignments for equipment and matches the personnel requirements listed in the matrix at Figure 6-2. The VRC 46 radio (13) is required at each forward signal center location. Thus an additional radio is shown at team 1, 3 and 5 as each center is established. Substitutability among

TASK	NO	TOE	1	2	3	4	5	6	7	8	9	10	11	12
CO CDR	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FIRST SGT	2	1												
FD SVC SGT	3	1												
MOTOR SGT	4	1												
SUPPLY SGT	5	1												
1 COOK	6	1												
COOK 5	7	1												
PGEN & WVM 5	8	2	1	1	1	1	1	1	2	2	2	2	2	2
ARMORER	9	1												
COOK 4	10	3												
PGEN & WVM 4	11	6		1	1	2	2	2	2	3	3	4	4	5
VEH DRV	12	1						1	1	1	1	1	1	1
GEN SUP SP	13	1												
NBC OP NCO	14	1												
PLL CLERK	15	1							1	1	1	1	1	1
PLT LDR	16	3	1	1	2	2	3	3	3	3	3	3	3	3
PLT SGT	17	3							1	1	2	2	3	3
PGEN & WVM 5	18	2	1	1	2	2	2	2	2	2	2	2	2	2
PGEN & WVM 4	19	4		1	1	2	3	4	4	4	4	4	4	4
TEAM CHIEF	20	3							1	1	2	2	3	3
TEL CT SP	21	9							1	2	3	4	5	6
MESSENGER	22	6	1	2	3	4	5	6	6	6	6	6	6	6
CIR CTL SGT	23	3							1	1	2	2	3	3
TAC CKT C5	24	3								1	1	2	2	3
WSYS TCH 5	25	3								1	1	2	3	3
TAC CRT C4	26	6							1	2	3	4	5	6
WSYS OP/SW	27	5								1	1	2	2	3
RATT OP SUP	28	3												
RATT OP GRC	29	18		2	2	4	4	6	6	7	7	8	8	9
RAD OP RWI	30	18	1	3	4	6	7	9	9	9	9	9	9	9
RATT OP CHAN	31	9	2	2	4	4	6	6	7	7	8	8	9	9
WSYS TM CHIEF	32	3	1	1	2	2	3	3	3	3	3	3	3	3
WSYS IN/OP	33	18	1	2	3	4	5	6	8	10	12	14	16	18
MCH COMM CH	34	12							2	2	4	4	6	6
MCH COMM OP	35	24							1	4	5	8	9	12

FIGURE 6-2. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, FORWARD COMMUNICATIONS COMPANY.

[illegible]

FIGURE 6-3. TRANSFER MATRIX, PERSONNEL, FORWARD COMMUNICATIONS COMPANY.

TASK	NO	TOE	1	2	3	4	5	6	7	8	9	10	11	12
UTIL 1/4 T	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CAR 5/2 SH	2	2	1	1	1	1	1	1	2	2	2	2	2	2
CAR 5/4 46	3	1	1	1	1	1	1	1	1	1	1	1	1	1
CAR 47	4	3	1	1	2	2	3	3	3	3	3	3	3	3
CAR 5/4 30	5	3							1	1	2	2	3	3
UTIL 1/4 T	6	3	1	1	2	2	3	3	3	3	3	3	3	3
CAR 5/4 76	7	3							1	1	2	2	3	3
CAR 5/4 29	8	3							1	1	2	2	3	3
CAR 5/4 46	9	3	1	1	2	2	3	3	3	3	3	3	3	3
CAR 5/4 49	10	3	1	1	2	2	3	3	3	3	3	3	3	3
CAR 5/4 142	11	9	2	2	4	4	6	6	7	7	8	8	9	9
CAR 5/2 6x6	12	3							1	1	2	2	3	3
UTIL 1/4 T	13	3	1	1	2	2	3	3	3	3	6	6	9	9
CAR 5/4 145	14	12							3	3	6	6	9	9

FIGURE 6-4. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, FORWARD COMMUNICATIONS COMPANY.

TRANSFER MATRIX FOR MATERIEL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	0					60								60
2		0												
3			0	45					60	00				
4			60	0					30	35				
5					0									
6	60					0							15	
7							0							
8								0						
9			60	15					0	30				
10			60	30					30	0				
11											0			
12												0		
13	60					15							0	
14														0

FIGURE 6-5. TRANSFER MATRIX, MATERIEL, FORWARD COMMUNICATIONS COMPANY.

equipment is shown in Figure 6-5 and is read the same as the personnel transfer matrix, except the reference number reflects the equipment item. Times shown in Figure 6-5 reflect the time for the equipment to be moved from one location to another plus any time that might be required to transfer mounted equipment. There is a general lack of substitutability among low-density items in this company, which will hinder mission accomplishment if these items of equipment are damaged and missing.

The AMORE methodology accepts these teams, matrices, and damage probabilities as input. Shortages of essential personnel and equipment are assessed as discussed in Chapter 2, and the model reassigns available personnel and equipment to reconstitute the maximum number of teams in the shortest possible time.

SECTION III

RESULTS

Figure 6-6 is a display of the effectiveness of the forward communications company as a function of time, considering only the three levels of combat damage. No degradation of performance from drug abuse is assumed. The unit is sensitive to damage (particularly to equipment) and loses a large percentage of capability for a like increase in damage. Note that unit effectiveness is limited by materiel in all cases. Personnel casualties of ten percent and severe materiel damage of three percent (Case 1) reduces the units effectiveness to about sixty percent. Note that it is the three percent damage to materiel (M) that limits unit effectiveness and not the ten percent personnel losses. At Damage Case 3 (thirty percent personnel and six percent materiel) the unit effectiveness cannot be increased beyond approximately forty percent.

Personnel functions and equipment that limited the forward support company's ability to function are listed in Figure 6-7. Personnel tasks essential to mission accomplishment are listed in the first column, ranked by criticality based on a detailed analysis of the unit's ability to recover its effectiveness after three levels of combat damage. An "X" indicates the damage level at which a particular function restricted the unit's ability to achieve a higher level of effectiveness. The top six personnel functions were critical at all damage levels. For the upper right of Figure 6-7 are listed those personnel functions, not in themselves essential, that were required to substitute for absent critical personnel. Equipment is listed in the bottom, right corner of the figure.

Figures 6-8 and 6-9 show the effectiveness of the forward communications company following combat damage (4 cases) as a function of varying levels of drug abuse. Two horizontal scales are shown. The upper scale is the percent of drug users among those susceptible to drug abuse (less than twenty-five years old). The lower scale is that equivalent percentage of the entire unit population. Thus ten percent of those less than twenty-five years old equates to seven percent of the unit's authorized strength. The dotted line indicates the limiting effects of materiel shortages at the various combat damage levels. There is little change in impact on effectiveness from materiel damage at cases 1, 2, or 3. Most effectiveness is lost with the initial three percent damage to equipment.

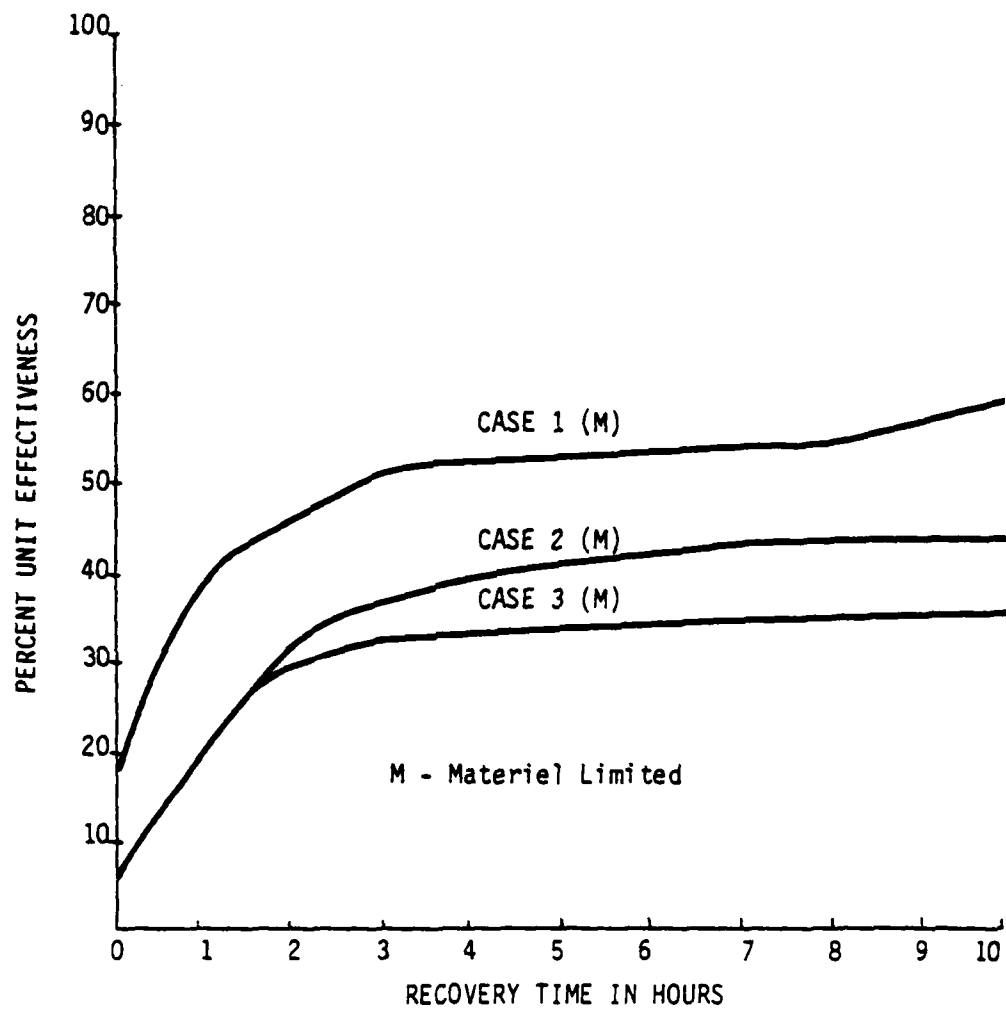


FIGURE 6-6. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, FORWARD COMMUNICATIONS COMPANY.

FORWARD COMMUNICATIONS COMPANY, BASE CASE

MINIMUM ESSENTIAL PERSONNEL		CRITICAL PERS. DAMAGE CASE		
TASK	NO.	1	2	3
COMMANDING OFFICER	1	X	X	X
WSYS TM CHIEF	32	X	X	X
PGEN & WVM4	19	X	X	X
WSYS IN/OP	23	X	X	X
PGEN & WVM5	18	X	X	X
TAC CKT C4	26	X	X	X
PGEN & WVM4	11			X
TEAM CHIEF	20			X
PGEN & WVM5	8		X	X
CIR CTL SGT	23	X		X
PLL CLERK	15		X	X
MESSENGER	22	X		X
TAC CKT C5	24	X		
PLT LDR	16			X
RATT OP CHAN	31			
VEH DRV	12			
RAD OP RWI	30			
PLT SGT	17			
WSYS TCH S	25			
RATT OP GRC	29			
TEL CT SP	21			
MCH COMM CH	34			
MCH COMM OP	35			
WSYS OP/SW	27			

REQUIRED SUBSTITUTES		DAMAGE CASE		
TASK	NO.	1	2	3
MOTOR SGT	4	X	X	X

CRITICAL EQUIPMENT		DAMAGE CASE		
TYPE	NO.	1	2	3
UTIL ½ T	1	X	X	X
CAR 5/2 SH	2		X	X
CAR 5/4 46	3			X
CAR 47	4	X	X	X
CAR 5/4 30	5		X	X
UTIL ½ T	6	X	X	X
CAR 5/4 T 76	7	X	X	X
CAR 5/4 T 29	8		X	X
CAR 5/4 T 46	9	X	X	X
CAR 5/4 T 49	10	X	X	X
CAR 5/4 T 142	11	X	X	X
CAR 5/2 T 6x6	12	X	X	X
UTIL ½ T	13	X	X	X

FIGURE 6-7. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT FOR VARIOUS LEVELS OF COMBAT DAMAGE, FORWARD COMMUNICATIONS COMPANY.

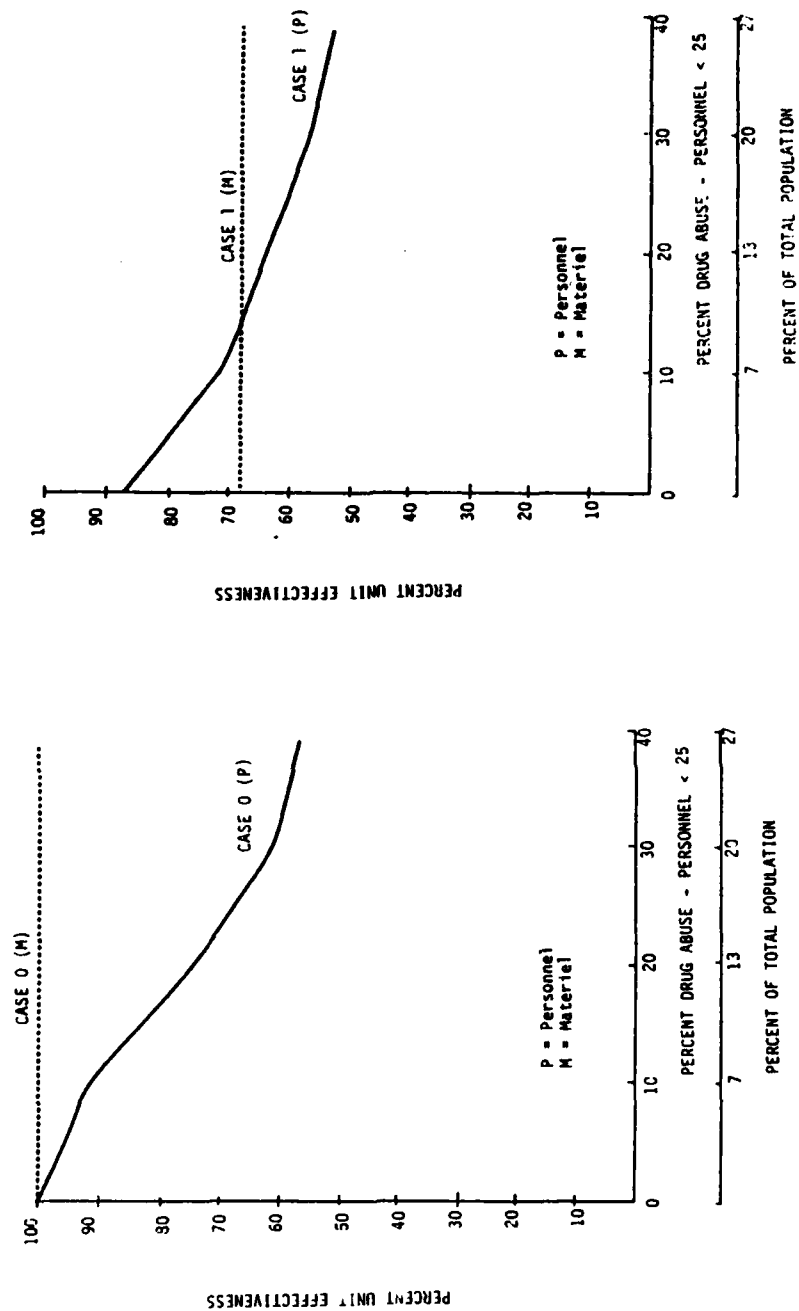


FIGURE 6-8. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 0 AND 1) AND VARIOUS LEVELS OF DRUG USE, FORWARD COMMUNICATIONS COMPANY.

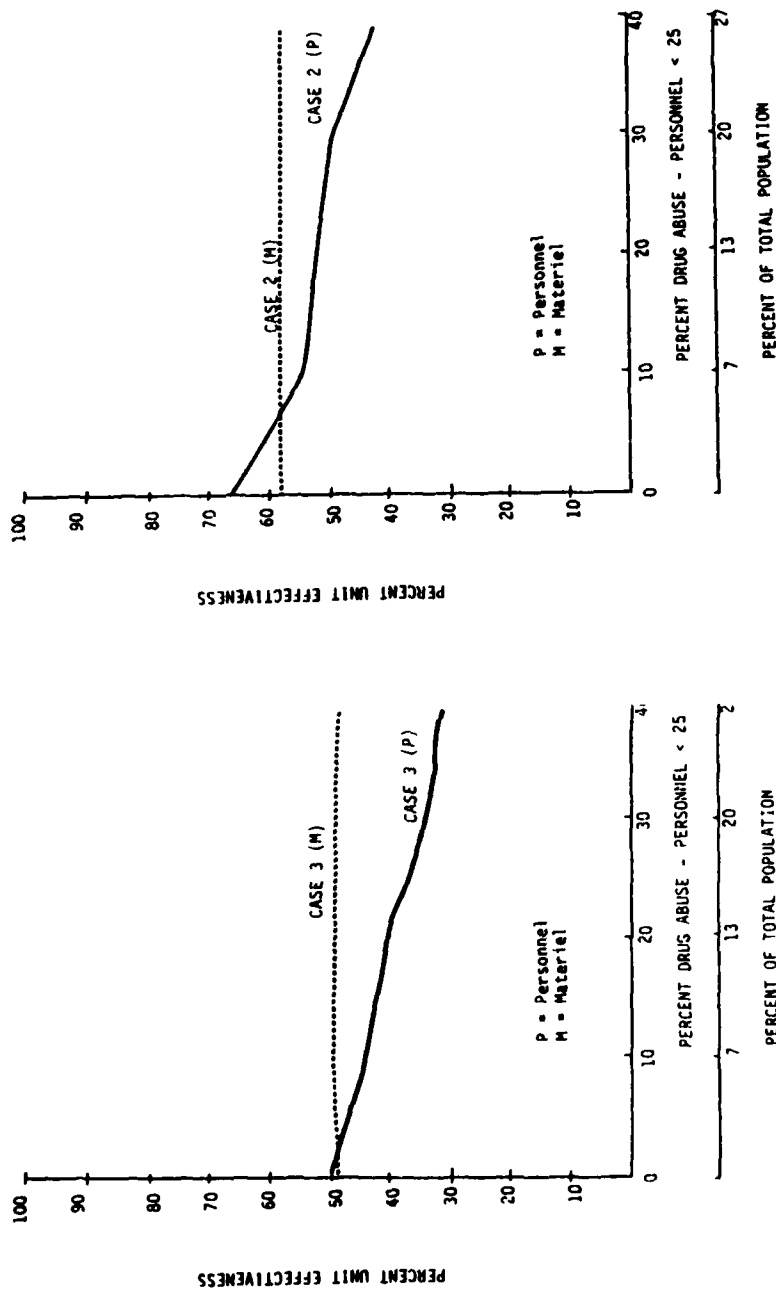


FIGURE 6-9. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 2 AND 3) AND VARIOUS LEVELS OF DRUG USE, FORWARD COMMUNICATIONS COMPANY.

The addition of drug abuse seriously reduces unit capability at Damage Case 0. Drug abuse has less of an effect when personnel losses from combat reach thirty percent. Table 6-3 shows the tolerance ratios for the forward communications company at each combat damage case. At Damage Case 0 the high ratio of .99 represents an almost one-for-one loss of effectiveness due to increased drug abuse. The smaller ratio of .47 at Case 3 reflects the reduced impact of drug abuse on the unit at this level of combat damage.

TABLE 6-3. TOLERANCE RATIOS, FORWARD COMMUNICATIONS COMPANY

	DAMAGE CASE			
	0	1	2	3
RATIO	.99	.81	.74	.47

Figures 6-12 through 6-13 show limiting functions in a format similar to Figure 6-7, but the critical personnel are now identified at each level of drug abuse for each of the four damage cases.

The first column lists the same mission-essential personnel functions ranked previously from combat damage considerations (Figure 6-7). The impact on unit effectiveness of adding drug abuse to combat damage resulted in the identification of additional personnel functions to the list of those previously considered critical. They are shown below in Table 6-4 along with the probability of being less than twenty-five years of age.

DAMAGE CASE 0

MINIMUM ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	1	2	3	4
COMMANDING OFFICER	1					
WSYS TM CHIEF	32		X	X	X	X
PGEN & WVM 4	19		X	X	X	X
WSYS IN/OP	33		X	X	X	X
PGEN & WVM 5	18		X	X	X	X
TAC CKT C4	26				X	
PGEN & WVM 4	11				X	X
TEAM CHIEF	20			X	X	X
PGEN & WVM 5	8					
CIR CTL SGT	23					
PLL CLERK	15		X	X	X	X
MESSENGER	22		X	X	X	X
TAC CKT C5	24					
PLT LDR	16					
RATT OP CHAN	31					
VEH DRV	12					
RAD OP RWI	30					
PLT SGT	17					
WSYS TCH S	25				X	
RATT OP GRC	29					
TEL CT SP	21					
MCH COMM CH	34					
MCH COMM OP	35					
WSYS OP/SW	27					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
MOTOR SGT	4		X	X	X	X

CRITICAL EQUIPMENT		DAMAGE CASE				
TYPE	NO.	0	1	2	3	4
NONE						

FIGURE 6-10. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), FORWARD COMMUNICATIONS COMPANY.

DAMAGE CASE 1

MINIMUM ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL					
TASK	NO.	0	1	2	3	4	
COMMANDING OFFICER	1	X	X				
WSYS TM CHIEF	32	X	X	X	X	X	
PGEN & WVM 4	19	X	X	X	X	X	
WSYS IN/OP	33	X	X	X	X	X	
PGEN & WVM 4	12	X	X	X	X	X	
TAC CKT C4	26	X	X	X	X	X	
PGEN & WVM 4	11					X	
TEAM CHIEF	20		X		X	X	
PGEN & WVM 5	8						
CIR CTL SGT	23	X	X	X			
PLL CLERK	15		X	X	X	X	
MESSENGER	22	X	X	X	X	X	
TAC CKT C5	24	X					
PLT LDR	16		X		X		
RATT OP CHAN	31			X			
VEV DRV	12						
RAD OP RWI	30						
PLT SGT	17				X		
WSYS TCH S	25		X				
RATT OP GRC	29						
TEL CT SP	21		X	X			
MCH COMM CH	34						
MCH COMM OP	35						
WSYS OP/SW	27						

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS					
TASK	NO.	0	1	2	3	4	
MOTOR SGT	4	X	X	X	X	X	

CRITICAL EQUIPMENT		DAMAGE CASE					
TYPE	NO.	0	1	2	3	4	
UTIL ½ T	1	X					
CAR 47	4	X					
UTIL ½ T	6	X					
CAR 5/4 T 76	7	X					
CAR 5/4 T 46	9	X					
CAR 5/4 T 49	10	X					
CAR 5/4 T 142	11	X					
CAR 5/4 T 6x6	12	X					
UTIL ½ T	13	X					

FIGURE 6-11. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), FORWARD COMMUNICATIONS COMPANY.

DAMAGE CASE 2

MINIMUM ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	1	2	3	4
COMMANDING OFFICER	1	X	X	X	X	X
WSYS TM CHIEF	32	X	X	X	X	X
PGEN & WVM 4	19	X	X	X	X	X
WSYS IN/OP	33	X	X	X	X	X
PGEN & WVM 5	18	X	X	X	X	X
TAC CKT C4	26	X	X	X		
PGEN & WVM 4	11					X
TEAM CHIEF	20		X	X	X	
PGEN & WVM 5	8	X			X	
CIR CTL SGT	23		X			
PLL CLERK	15	X	X	X	X	X
MESSENGER	22		X	X	X	X
TAC CKT C5	24					
PLT LDR	16		X			X
RATT OP CHAN	31					
VEH DRV	12			X	X	X
RAD OP RWI	30					
PLT SGT	17		X			
WSYS TCH S	25			X		
RATT OP GRC	29					
TEL CT SP	21					
MCH COMM CH	34					
MCH COMM OP	35					
WSYS OP/SW	27					

REQUIRED SUBSTITUTE		DRUG-ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
MOTOR SGT	4	X	X	X	X	X

CRITICAL EQUIPMENT		DAMAGE CASE				
TYPE	NO.	0	1	2	3	4
UTIL ½ T	1	X				
CAR 5/2 SH	2	X				
CAR 47	4	X				
CAR 5/4 30	5	X				
UTIL ½ T	6	X				
CAR 5/4 T 76	7	X				
CAR 5/4 T 29	8	X				
CAR 5/4 T 46	9	X				
CAR 5/4 T 49	10	X				
CAR 5/4 T 142	11	X				
CAR 5/4 T 6x6	12	X				
UTIL ½ T	13	X				

FIGURE 6-12. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 2), FORWARD COMMUNICATIONS COMPANY.

DAMAGE CASE 3

MINIMUM ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG ABUSE				
TASK	NO.	0	1	2	3	4
COMMANDING OFFICER	1	X	X	X	X	X
WSYS TM CHIEF	32	X	X	X	X	X
PGEN & WVM 4	19	X	X	X	X	X
WSYS IN/OP	33	X	X	X	X	
PGEN & WVM 5	18	X	X	X	X	X
TAC CKT C4	26	X	X			
PGEN & WVM 4	11	X		X	X	X
TEAM CHIEF	20	X				
PGEN & WVM 5	8	X	X			X
CIR CTL SGT	23	X	X			
PLL CLERK	15	X	X	X	X	
MESSENGER	22	X	X	X	X	X
TAC CKT C5	24		X			
PLT LDR	16	X	X	X	X	X
RATT OP CHAN	31		X	X	X	X
VEH DRV	12					X
RAD OP RWI	30					X
PLT SGT	17					
WSYS TCH S.	25					
RATT OP GRC	29					
TEL CT SP	21					
MCH COMM CH	34					
MCH COMM OP	35					
WSYS OP/SW	27					

REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
MOTOR SGT	4	X	X	X	X	X

CRITICAL EQUIPMENT		DAMAGE CASE				
TYPE	NO.	0	1	2	3	4
UTIL ½ T	1	X				
CAR 5/2 SH	2	X				
CAR 5/4 46	3	X				
CAR 47	4	X				
CAR 5/4 30	5	X				
UTIL ½ T	6	X				
CAR 5/4 T 76	7	X				
CAR 5/4 T 29	8	X				
CAR 5/4 T 46	9	X				
CAR 5/4 T 49	10	X				
CAR 5/4 T 142	11	X				
CAR 5/4 T 6x6	12	X				
UTIL ½ T	13	X				

FIGURE 6-13. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 3), FORWARD COMMUNICATIONS COMPANY.

TABLE 6-4. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE, FORWARD COMMUNICATIONS COMPANY

Personnel Critical From Combat Damage Only

TASK	MOS	P<25
CO CDR.	25A0	0
WSYS TM CHIEF	36C2	.34
PGEN & WVM-4	63B1	.87
WSYS IN/OP	31N3	.08
PGEN & WVM-5	63B2	.35
TAC CKT CTL-4	31N2	.47
PGEN & WVM-4	63B1	.87
TEAM CHIEF	72E2	.36
PGEN & WVM-5	63B2	.35
CIR CTL SGT	31N3	.08
PLL CLERK	76D1	.79
MESSENGER	72F1	.87
TAC CKT CT 3-5	31N2	.47
PLT LDR	25A0	.43

Additional Personnel Critical From Drug Abuse

TASK	MOS	P<25
RATT OP CHANN	05C2	.43
VEH DVR	72E1	.87
RAD OP RWI	05B1	.87
PLT SGT	31Z4	0
TAC CLT CTL-5	36C2	.34
TEL CT SP	72E1	.87

CHAPTER 7

HEADQUARTERS COMPANY, INFANTRY BATTALION SPECIAL CASE

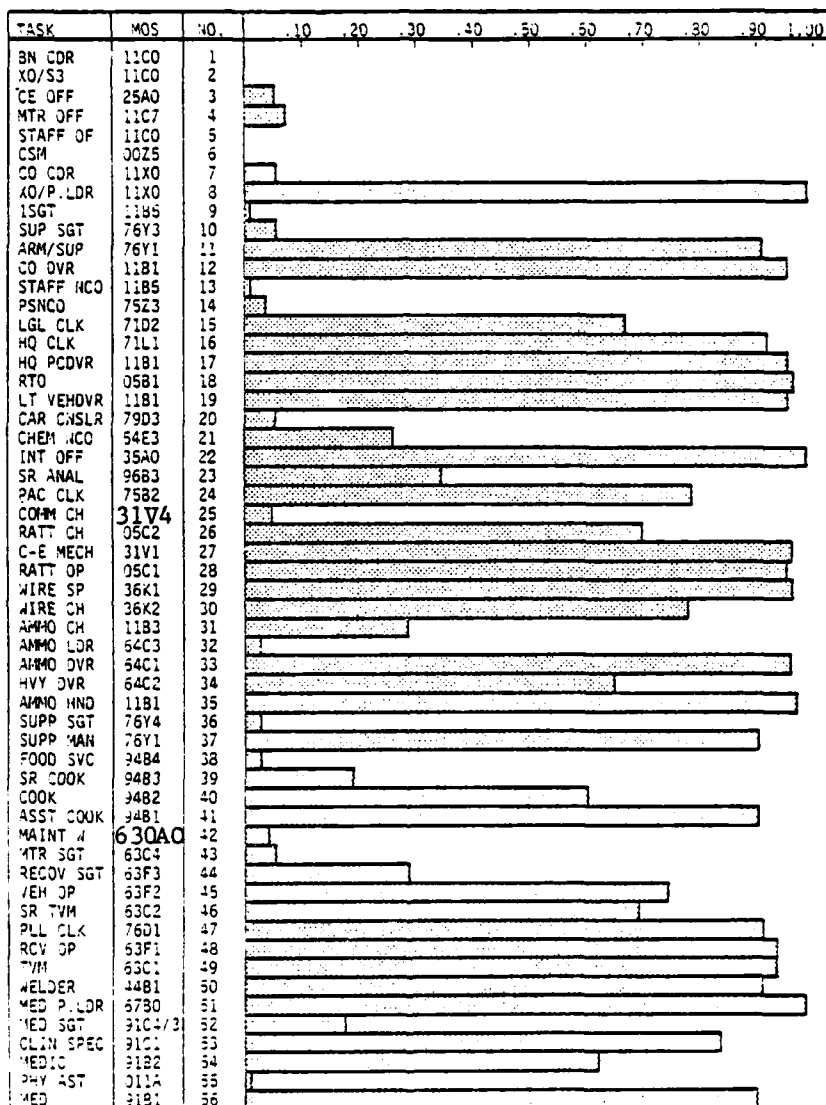
One of the key assumptions in the analysis of the impact of drug abuse on combat effectiveness is that drug-abuse susceptibility is limited to personnel under twenty-five. To test the leverage of this assumption on unit effectiveness it was decided to change the probability of drug-abuse susceptibility in one of the units previously examined and analyze any difference in results. Headquarters company, infantry battalion, was selected as the unit for re-evaluation because of the relatively small impact drug abuse had on effectiveness using age twenty-five as the upper limit. This company also has a wide age spectrum across a large population, which would make the results more sensitive to changes in age assumptions. Age twenty-eight was selected as the new upper limit. The probability of each MOS being occupied by someone under 28 is shown in Table 7-1. These probabilities are the only changes made to the input for computer runs described in Chapter 5 of the basic report. Combat-damage probabilities, team compositions and drug abuse levels all remain the same. The percent of the company under twenty-eight is seventy percent as compared to 68.4% under twenty-five.

Unit effectiveness as a function of drug abuse is shown in Figure 7-1 for Damage Cases 0 and 1 and in Figure 7-2 for Damage Cases 2 and 3. As before, two horizontal scales are shown. The top scale reflects the percent of those susceptible to drug abuse; the bottom scale shows the equivalent percent of total population. Note that ten percent of those under twenty-eight equates to seven percent of the unit. The dotted line at one hundred percent reflects the lack of impact materiel losses had on unit effectiveness at these damage levels.

Figure 7-3 compares the results of the two assumptions on effectiveness as a function of drug abuse for all combat-damage cases.

At Damage Case 0, there is no difference in effectiveness at ten percent and twenty percent drug abuse. At thirty percent and forty percent there is a difference of eight percent in unit effectiveness for age twenty-eight. With additional casualties from combat, the difference in effectiveness remains approximately eight percent at the higher drug-abuse levels (twenty percent to forty percent). There is no significant difference in effectiveness for drug-abuse levels of ten percent. A loss of eight percent in effectiveness at the higher drug-abuse levels is significant, considering the small (1.6%) increase in population vulnerability.

TABLE 7-1. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 28 YEARS OF AGE, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).



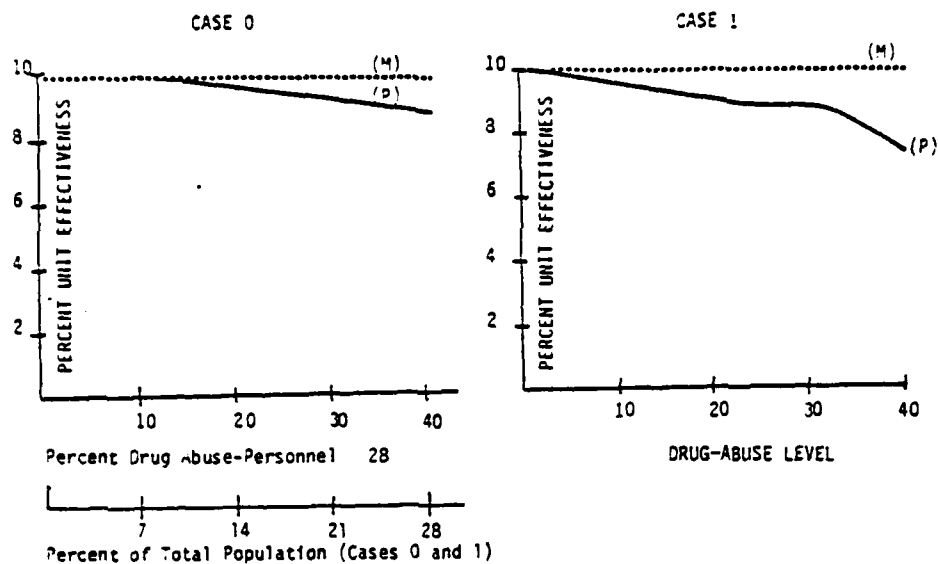


FIGURE 7-1. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 0 AND 1)
HHC, INFANTRY BATTALION (MECH).

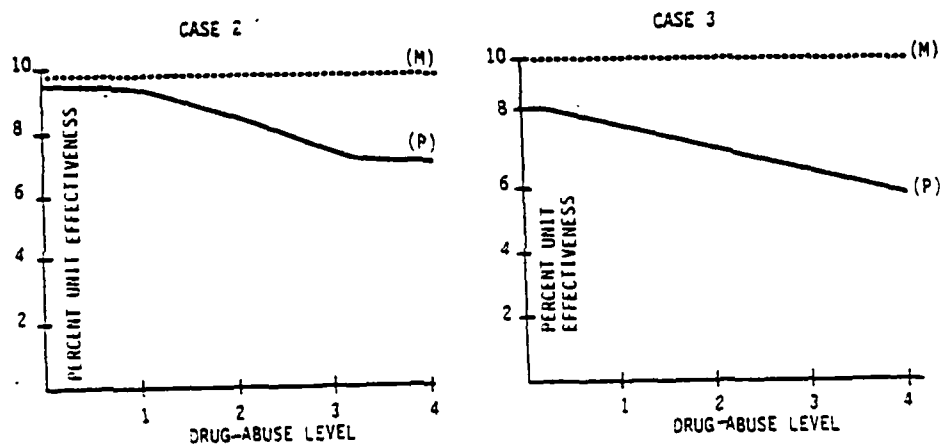


FIGURE 7-2. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 2 AND 3)
HHC, INFANTRY BATTALION (MECH).

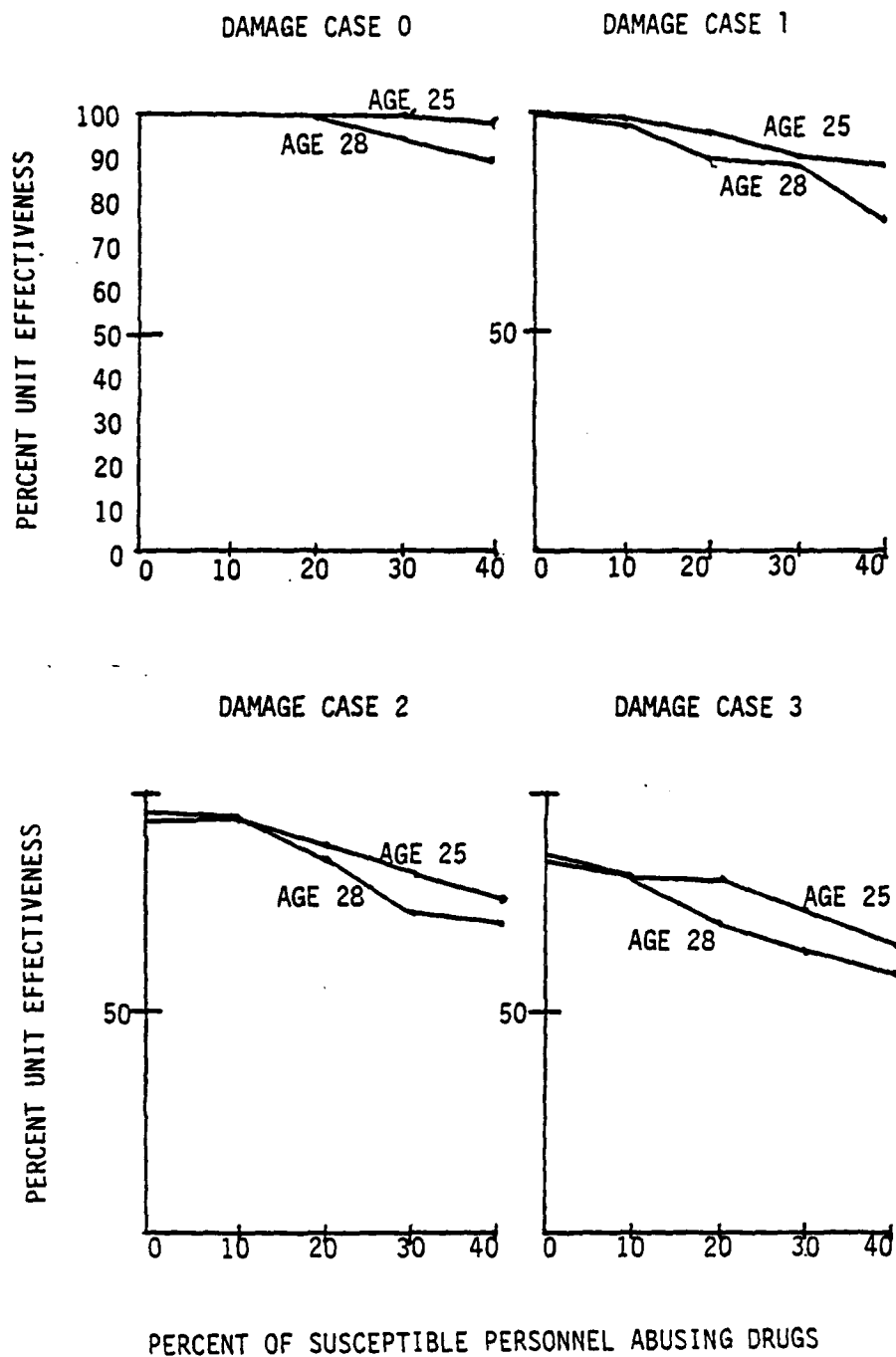


FIGURE 7-3. COMPARISON OF UNIT EFFECTIVENESS BY DAMAGE CASE, HEADQUARTERS COMPANY, INFANTRY BATTALION. AGE 25 VS AGE 28 AS THRESHOLD FOR DRUG-ABUSE AVOIDANCE.

Critical personnel and those non-essential functions which were required to substitute for vacancies in critical functions are listed for each damage case in Figures 7-4 through 7-7 respectively. The critical functions are ranked according to criticality from a detailed analysis of the unit's reconstitution following combat damage. An "X" to the right of a personnel task indicates the drug-abuse level at which a shortage of that particular function limited unit effectiveness when drug abuse susceptibility was bounded by age twenty-five. A zero indicates the task was critical when twenty-eight was the age limit. If the model choked at both twenty-five and twenty-eight the drug level is indicated by "0". It is of interest to note that with the increased age threshold only two additional personnel functions were identified as critical to unit reconstitution. These are the Headquarters Commandant (P 28 = .532) and the Senior Analyst (P 28 = .342).

DAMAGE CASE 0

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERSONNEL					REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4	TASK	NO.	0	.1	.2	.3	.4
RATT TEAM CH	26				0	0	C-E OFFICER	3		0	0	0	0
RATT OPERATOR	28			X	0	0							
COMMO CHIEF	25												
C-E MECH	27			⊗	0	⊗							
WIRE SPECIAL	29				0	⊗							
BATTALION CDR	1												
LT VEH DVR	19												
BN EXEC/S-3	2												
HQ CDR	7												
STAFF SGT	13												
HQ CAR DVR	17												
INTEL OFF	22												
VEH DVR	33												
S-1/2/3/4	5												
CO DVR	12												
RTO	18												
SR ANALYST	23												
CLERK	16												

X = critical at age 25
 0 = critical at age 28
 ⊗ = critical at both ages

CRITICAL EQUIPMENT
NONE

FIGURE 7-4. MISSION-LIMITING PERSONNEL FUNCTION AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 0), HHC, INFANTRY BATTALION (MECH).

DAMAGE CASE 1

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERSONNEL DRUG LEVEL					REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4	TASK	NO.	0	.1	.2	.3	.4
RATT TM CH	26		0	0	(X)	(X)	C-E OFFICER	3	(X)	(X)	(X)	(X)	(X)
RATT OP	28		0	0	(X)	(X)	WIRE TM CH	30			(X)	(X)	(X)
COMMO CH	25		0	X	0	(X)							
C-E MECH	27		X	(X)	(X)	(X)							
WIRE SPEC	29			(X)	(X)	(X)							
BN CDR	1												
LT VEH DVR	19												
BN EXEC/S-3	2												
HQ CDR	7												
STAFF SGT	13												
HQ CARR. DVR	17												
INTEL OFF	22												
VEH DVR	33												
S-1/2/3/4	5			0		0							
CO DVR	12												
RTO	18												
SR ANALYST	23												
CLERK	16												

X = critical at age 25
 0 = critical at age 28
 (X) = critical at both ages

CRITICAL EQUIPMENT
NONE

FIGURE 7-5. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), HHC, INFANTRY BATTALION (MECH).

DAMAGE CASE 2

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERSONNEL DRUG LEVEL					REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4	TASK	NO.	0	.1	.2	.3	.4
RATT TM CH	26	⊗	⊗	⊗	⊗	⊗	CE OFF	3	⊗	⊗	⊗	⊗	⊗
RATT OP	28	0	X	⊗	⊗	⊗	WIRE TM CH	30	0	⊗	0	⊗	⊗
COMM CH	25	⊗	⊗	⊗	⊗	⊗							
C-E MECH	27	⊗	⊗	⊗	⊗	⊗							
WIRE SP	29		⊗	⊗	⊗	⊗							
BN CDR	1		X	0	0	0							
LT VEH DVR	19												
BN EXEC/S-3	2					0							
HQ CDR	7				0	0							
STAFF SGT	13												
HQ CARR DVR	17												
INTEL OFF	22												
VEH DVR	33												
S-1,2,3,4	5	0		0		0							
CO DVR	12												
RTO	18												
SR-ANAL	23												
CLERK	16												

X = critical at age 25
 0 = critical at age 28
 ⊗ = critical at both ages

CRITICAL EQUIPMENT

HQ CARRIER

FIGURE 7-6. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 2), HHC, INFANTRY BATTALION (MECH).

DAMAGE CASE 3

MISSION-ESSENTIAL PERSONNEL		CRITICAL PERSONNEL DRUG LEVEL					REQUIRED SUBSTITUTES		DRUG-ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4	TASK	NO.	0	.1	.2	.3	.4
RATT TEAM CH	26	⊗	⊗	⊗	⊗	⊗	C-E OFFICER	3	⊗	⊗	⊗	⊗	⊗
RATT OPERATOR	28	⊗	⊗	⊗	⊗	⊗	WIRE T: CH	30	0	0	⊗	⊗	⊗
COMM CHIEF	25	⊗	⊗	⊗	⊗	⊗							
C-E MECH	27	⊗	⊗	⊗	⊗	⊗							
WIRE SPEC.	29	⊗	⊗	⊗	⊗	⊗							
BATTALION CDR	1		X	⊗	0	⊗							
LT VEH DVR	19												
BN EXEC/S-3	2		0	⊗		0							
HQ CDR	7				0	0							
STAFF SGT	13												
CARR DVR	17												
INTEL OFF	22												
VEH DVR	33												
S-1/2/3/4	5		0	0	⊗	⊗							
CO DVR	12												
RTO	18												
SR ANALYST	23			0									
CLERK	16												

X = critical at age 25
 0 = critical at age 28
 ⊗ = critical at both ages

CRITICAL EQUIPMENT
NONE

FIGURE 7-7. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 3), HHC, INFANTRY BATTALION (MECH).

APPENDIX A

PROBABILITY OF PERSONNEL BEING LESS THAN TWENTY-FIVE YEARS OF AGE

This appendix presents the probabilities that personnel assigned to selected tasks in forward support, combat engineer, supply and service and forward communications companies, are less than twenty-five years of age. In addition, data are presented for the probability that personnel assigned tasks in the Headquarters Company, Infantry Battalion (Mechanized), are less than twenty-eight years of age. The data are presented in Tables A-1 through A-6.

The U.S. Army MILPERCEN provided SAI with distributions by date of birth and duty MOS of all Army personnel assigned to Europe. These data were used to calculate the probability that personnel, assigned to selected tasks in each unit analyzed, were less than twenty-five years of age or twenty-eight years of age for the personnel of the headquarters company, infantry battalion (Mechanized).

The resulting probabilities were used in calculating the assumed incidence of drug abuse for each unit. Not surprisingly, none of the higher ranking officers and noncommissioned officers were under twenty-five years of age and, by assumption, therefore, were not considered potential drug users. In examining the HHC with the age increased to twenty-eight some higher-ranking officers previously unaffected became susceptible to drug abuse. This was also the case for some NCO's.

Table A-1 is a summary of the age distribution for each of the five units analyzed in this study. The table presents the total personnel assigned to each unit and the percentage of those assigned who could be expected to be under twenty-five years of age (and twenty-eight for HHC).

TABLE A-1. EXPECTED PERCENTAGE OF PERSONNEL
LESS THAN 25 YEARS OF AGE IN EACH
UNIT, AND 28 IN HHC, INFANTRY BN

COMPANY	TOTAL PERSONNEL	PERCENTAGE < 25
Forward Support Company	189	.640
Combat Engineer Company	153	.667
Supply & Service Company	125	.641
Forward Communications Company	179	.667
Headquarters Company, Infantry Bn	173	.684
PERCENTAGE < 28		
Headquarters Company, Infantry BN	173	.700

TABLE A-2. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, FORWARD SUPPORT COMPANY

TASK	MOS	NO	P<25
COMMANDER	77A0	1	0
FIRST SGT	6325	2	0
FOOD SVC SGT	94B4	3	.01
FIRST COOK	94B3	4	.04
COOK 2	94B2	5	.26
COOK 1	94B1	6	.73
MOTOR SGT	63C4	7	.01
PG 3 WV MECH-5	63B2	8	.35
PG 3 WV MECH-4	63B1	9	.87
SUPPLY SGT	76Y3	10	.05
GEN SUPPLY	76Y1	11	.76
EG CLK/MAT SP	76D1	12	.79
CONST EQ MECH	62B1	13	.88
LT VEH DVR	64C1	14	.24
NCO/PLT LDR	77A0	15	.44
NCS/PLT SGT	63H4	16	0
ARM MNT INSP	45K3	17	.07
PVR GEN REP 6	52D3	18	.04
AUTO TECH INS	63H3	19	.05
RECORD CLERK	71L1	20	.77
AUTO REP WO	63A0	21	0
AUTO REP NCO	63H2	22	.32
FUEL/ELEC NCO	63G2	23	.31
AUTO REP-4	63H1	24	.87
FUEL/ELEC REP	63G1	25	.87
ARM MAT WO	42A1	26	0
ARM MAT NCO	45Z4	27	.01
ART REP-5	45L2	28	.23
FIRE CON IN-5	41C2	29	.31
TANK TUR NCO	45K2	30	.30
ART REP-3	45L1	31	.78
FIRE CON IN-4	41C1	32	.72
SM ARM REP	45B1	33	.84
TANK TUR RP-1	45K1	34	.86
FLD RAD RP-5	31E3	35	.03
D/M CEN OFC	36H2	36	.39
FLD RAD RP-5	31E2	37	.48
SP ELEC DEV-5	35E2	38	.33
CBT ASR RP	26C1	39	.74
DMCOR 1	36H1	40	.82
SP ELEC DEV-4	35E1	41	.72
TELETYPE REP	31J1	42	.86
FLD RAD REP-4	31E1	43	.04
CONST EQ REP-5	62B2	44	.44
PVR GEN REP-5	52D2	45	.36
CHEM EQ REP-4	54D1	46	.84
PVR GEN REP-4	52D1	47	.76
QM EQ REP	63J1	48	.86
SPT SUP WO	76A2	49	0
MAT SUP SGT	76D3	50	.02
MAT SUP SP	76D2	51	.26
PAC/CRAT	76V1	52	.73
SEC CH/MET	44B3	53	.06
REC VEH OPR	63F2	54	.44
WELDER N	44B2	55	.40
LFT/LD OPR	62F1	56	.36
MACHINIST	44E1	57	.31
METAL WRK	44B1	58	.33
REC VEH OPR	63F1	59	.30
ABC SPNS 1	54F2	60	.22

TABLE A-3. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, COMBAT ENGINEER COMPANY

TASK	MOS	NO	P<25
CO COMMANDER	21A0	1	0
XO	21A0	2	.44
COMM CHIEF	31H3	3	.06
PER CARR DVR	12B1	4	.90
TAC WIRE SP	36K1	5	.86
CEV COMMANDER	19E3	6	.04
CEV GUNNER	19E2	7	.12
CONST EQ OP-5	62E2	8	.59
CONST EQ OP-4	62E1	9	.38
GEN CONST. OP-4	62E1	10	.28
CEV DRIVER	19E1	11	.03
DUMP TRK DVR	64C1	12	.84
CEV LODR	19E1	13	.03
CONST EQ OP-4	62E1	14	.88
MOTOR SGT	63C4	15	.01
SUP SGT	76Y3	16	.05
ARMORER	76Y1	17	.76
CONST EQ MH-4	62B1	18	.88
PLL CLERK	76D1	19	.79
TV MECH-4	63C1	20	.90
PGEN MECH-4	63B1	21	.86
CONST EQ MECH-3	62B1	22	.88
GENL SUP	76Y1	23	.76
TV MECH-3	63C1	24	.90
VEH DVR-3	12B1	25	.90
PGEN MECH-3	63B1	26	.86
1 SGT	12Z5	27	0
FD SVC CH	94B4	28	0
1 COOK	94B3	29	.04
COOK 5	94B2	30	.26
COOK 4/3	94B1	31	.73
NBC NCO	54E2	32	.14
PLATOON LEADER	21A0	33	.44
PLATOON SGT	12B4	34	.02
CONST SPEC-4	12B1	35	.90
VEH DRIVER-4	12B1	36	.90
TOOL ROOM KEEPER	12B1	37	.90
5 TON DRIVER	12B1	38	.90
SQUAD LEADER	12B3	39	.06
ASST SQD LDR	12B2	40	.50
DEMO SPEC	12B2	41	.50
CONST SPEC-4	12B1	42	.90
DEMO ASST	12B1	43	.90
PERS CARR DVR	12B1	44	.90
COMBAT CONST	12B1	45	.90

TABLE A-4. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, SUPPLY AND SERVICE COMPANY

TASK	MOS	NO	P<25
CO CDR	92A0	1	0
SPL OFF/PL	92A0	2	.11
1 SGT	76Z5	3	0
MTR SGT	63C4	4	.01
SUP SG/PH	76D4	5	.01
SUP SG/CIF	76Y3	6	.05
PGEN MECH-S	63B2	7	.35
ARMORER	76Y1	8	.76
PLL/SUP SP	76D1	9	.79
PGEN & WVM	63B1	10	.87
QM	63J1	11	.86
TAC WIR OB	63K1	12	.86
VEH DVR	64C1	13	.84
NBC NCO	54E2	14	.20
REPORT CLERK	71L1	15	.77
SUP SUPV	76X4	16	0
RAT DIST	76X2	17	.33
SUB SUP	76X1	18	.78
WHSE OP	76V1	19	.73
SCT SGT	76W4	20	0
POL SGT	76W3	21	.05
LOD OPR	62F1	22	.86
POL SPL	76W1	23	.86
QUAL SP	92C1	24	.76
SEC SGT	76D3	25	.02
MTL SUP	76D2	26	.26
SUP TCH	76A1	27	0
SUP SGT 7	76Y4	28	.01
MAT SPV	76D3	29	.02
ST CLK	76D2	30	.26
ST SPEC	76V1	31	.73
SUP SPEC	76D1	32	.79
POL SPEC	76W1	33	.86
SUB SPEC	76X1	34	.78

TABLE A-5. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, FORWARD COMMUNICATIONS COMPANY

TASK	MOS	NO	P<25
COMPANY CDR	25A0	1	0
FIRST SGT	31Z5	2	0
FOOD SVC SGT	94B4	3	0
MOTOR SGT	63B3	4	.05
SUPPLY SGT	76Y3	5	.05
FIRST COOK	94B3	6	.04
COOK	94B2	7	.26
PGEN WVM	63B2	8	.35
ARMORER	76Y1	9	.76
COOK	94B1	10	.73
PGEN WVM	63B1	11	.87
VEHICLE DVR	72E1	12	.87
GEN SUP SPEC	76Y1	13	.76
NBC OPNS NCO	54E2	14	.20
PLL CLERK	76D1	15	.79
PLT LEADER	25A0	16	.43
PLT SGT	31Z4	17	0
PGEN WVM	63B2	18	.35
PGEN WVM	63B1	19	.87
TEAM CHIEF	72E2	20	.36
TEL COM SPEC	72E1	21	.87
MESSENGER	72E1	22	.87
CKT CTL SGT	31N3	23	.08
TAC CKT CTL	31N2	24	.47
WSYS TM CHIEF	36C2	25	.34
TAC CKT CTL	31N2	26	.47
WSYS IN/OP	36C1	27	.88
RATT OPNS SUPV	05C3	28	.02
RATT OPR	05C1	29	.84
RADIO OPR	05B1	30	.87
RATT OPNS TM CH	05C2	31	.43
WSYS TM CH	36C2	32	.34
WSYS IN/OP	36C1	33	.88
MCHAN COMM TM CH	31M2	34	.40
MCHAN COMM EQ OPR	31M1	35	.87

TABLE A-6. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 28 YEARS OF AGE, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH)

TASK	MOS	NC.	P<28
BN CDR	11C0	1	0
XO/S3	11C0	2	0
CE OFF	25A0	3	.51
MTR OFF	11C7	4	.82
STAFF OF	11C0	5	.53
CSM	00Z5	6	0
CO CDR	11X0	7	.53
XO/P. LDR	11X0	8	1.0
1 SGT	11B5	9	.02
SUP SGT	76Y3	10	.21
ARM/SUP	76Y1	11	.90
CO DVR	11B1	12	.96
STAFF NCO	11B5	13	.01
PSNCO	75Z3	14	.26
LGL CLK	71D2	15	.68
HQ CLK	71L1	16	.91
HQ PCOVR	11B1	17	.96
RTO	05B1	18	.96
LT VEH DVR	11B1	19	.96
CAR CHSLR	79D3	20	.05
CHEM NCO	54E3	21	.26
INT OFF	35A0	22	1.0
SR ANAL	96B3	23	.34
PAC CLK	75B2	24	.79
COMM CH	31V4	25	.04
RATT CH	05C2	26	.72
C-E MECH	31V1	27	.96
RATT OP	05C1	28	.94
WIRE SP	36K1	29	.95
WIRE CH	36K2	30	.78
AMMO CH	11B2	31	.28
AMMO LDR	64C3	32	.12
AMMO DVR	64C1	33	.94
HVY DVR	64C2	34	.64
AMMO HND	11B1	35	.96
SUPP SGT	76Y4	36	.02
SUPP MAN	76Y1	37	.90
FOOD SVC	94B4	38	.02
SR COOK	94B3	39	.18
COOK	94B2	40	.59
ASST COOK	94B1	41	.88
MAINT W	63A0	42	.03
MTR SGT	63C4	43	.04
RECOV SGT	63F3	44	.31
VEH OP	63F2	45	.76
SR TVM	63C2	46	.70
PLL CLK	76D1	47	.92
RCV OP	63F1	48	.96
TVM	63C1	49	.97
WELDER	44B1	50	.91
MED P. LDR	67B0	51	1.0
MED SGT	91C4/3	52	.18
CLIN SPEC	91C1	53	.34
MEDIC	91B2	54	.62
PHY AST	01A1	55	.01
MED	91B1	56	.30

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VOLUME II - FINAL REPORT

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April 1980

Supported by:

U.S. Army Medical Research and Development Command
Fort Detrick, Frederick, Maryland 21701

Contract No. DAMD 17-79-C-9107

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